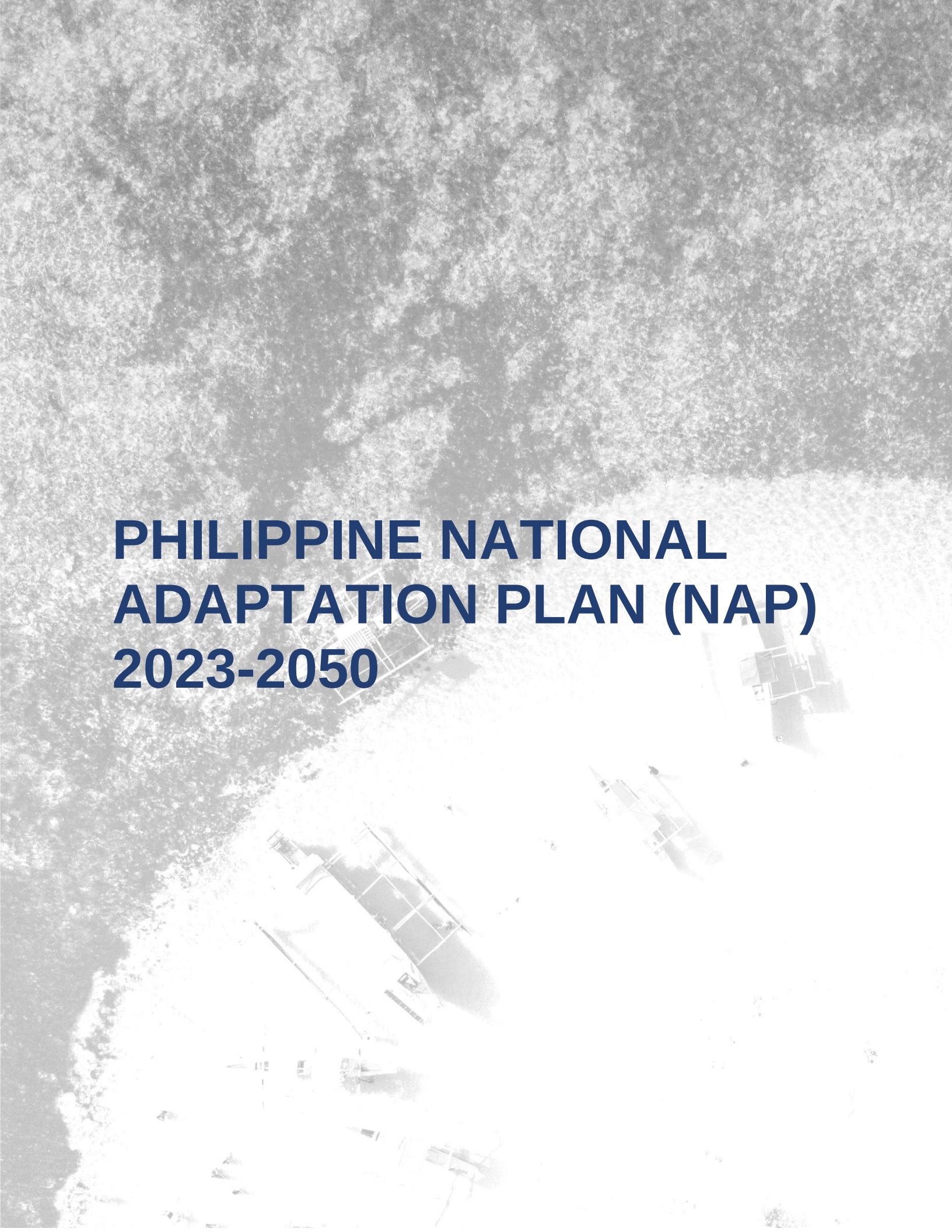


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PHILIPPINE NATIONAL ADAPTATION PLAN (NAP) 2023-2050



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An aerial photograph of a tropical coastline. The top half of the image shows a dense, dark green forest. The bottom half shows a bright, sandy beach with several buildings and structures. The text is overlaid on the forest area.

PHILIPPINE NATIONAL ADAPTATION PLAN (NAP) 2023-2050

“

*I have always believed that there is no greater shared responsibility than the care of our environment... and as your President, I assure you **that our environment and our country's resiliency and adaptation to the new normal of climate change are on top of the national agenda.***

*The economic agenda cannot and will not ever be incompatible with our climate change agenda. **Climate change is now an important criterion in our integral national policies, in planning, decision-making, up to the implementation of programs.** The potential advantages of such enlightened policies extend to jobs and livelihood, with the unlocking of the development of the green and blue economies.*

President Ferdinand Romualdez Marcos, Jr.





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Foreword



Foreword

[TO BE UPDATED]



Glossary and Abbreviations



Glossary

10-year return period flooding	Flood that an exceedance probability of 0.10 or a 10% chance that the flow will exceed in one year
Adaptation	In human systems, the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities. In natural systems, the process of adjustment to actual climate and its effects; human intervention may facilitate adjustment to expected climate and its effects
Adaptive capacity	Assets and abilities of the exposed element to address risk and vulnerability
Adaptation limit	The point at which an actor's objectives (or system needs) cannot be secured from intolerable risks through adaptive actions
Adaptation pathway	A planning approach addressing the uncertainty and challenges of climate change decision-making
Biodiversity	The variability among living organisms from terrestrial, marine, and other ecosystems. Biodiversity includes variability at the genetic, species, and ecosystem levels
Biodiversity hotspot	Biodiversity hotspots are geographic areas exceptionally rich in species, ecologically distinct, and often contain geographically rare endemic species. They are thus priorities for nature conservation action
Capacity building	The practice of enhancing the strengths and attributes of, and resources available to, an individual, community, society or organization to respond to change.
Cascading impacts	Cascading impacts from extreme weather/climate events occur when an extreme hazard generates a sequence of secondary events in natural and human systems that result in physical, natural, social or economic disruption, whereby the resulting impact is significantly larger than the initial impact.
Climate	Defined as the average weather -or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities- over a period of time ranging from months to thousands or millions of years.
Climate change	A change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcings such as modulations of the solar cycles, volcanic eruptions and persistent anthropogenic changes in the composition of the atmosphere or in land use.
Climatic impact-drivers	Physical climate system conditions (e.g., means, extremes, events) that affect an element of society or ecosystems
Co-benefit	A positive effect that a policy or measure aimed at one objective has on another objective, thereby increasing the total benefit to society or the environment



Community-based adaptation	Local, community-driven adaptation. Community-based adaptation focuses attention on empowering and promoting the adaptive capacity of communities. It is an approach that takes context, culture, knowledge, agency and preferences of communities as strengths
Coral bleaching	Loss of coral pigmentation through the loss of intracellular symbiotic algae (known as zooxanthellae) and/or loss of their pigments.
Coral reef	An underwater ecosystem characterized by structure-building stony corals. Warm-water coral reefs occur in shallow seas, mostly in the tropics, with the corals (animals) containing algae (plants) that depend on light and relatively stable temperature conditions. Cold-water coral reefs occur throughout the world, mostly at water depths of 50–500 m. In both kinds of reef, living corals frequently grow on older, dead material, predominantly made of calcium carbonate (CaCO ₃). Both warm- and cold-water coral reefs support high biodiversity of fish and other groups, and are considered to be especially vulnerable to climate change.
Coupled Model Intercomparison Project (CMIP)	A climate modelling activity from the World Climate Research Programme (WCRP) which coordinates and archives climate model simulations based on shared model inputs by modelling groups from around the world. The CMIP3 multi-model data set includes projections using Special Report on Emissions Scenarios (SRES) scenarios. The CMIP5 data set includes projections using the Representative Concentration Pathways (RCP). The CMIP6 phase involves a suite of common model experiments as well as an ensemble of CMIP-endorsed Model Intercomparison Projects (MIPs).
Cultural Impacts	Cultural impacts are closely related to ecological impacts, especially for iconic and representational dimensions of species and landscapes. Culture and cultural practices frame the importance and value of the impacts of change, shape the feasibility and acceptability of adaptation options, and provide the skills and practices that enable adaptation
Disaster management	Social processes for designing, implementing and evaluating strategies, policies and measures that promote and improve disaster preparedness, response and recovery practices at different organizational and societal levels
Disaster risk	The likelihood over a specified time period of severe alterations in the normal functioning of a community or a society due to hazardous physical events interacting with vulnerable social conditions, leading to widespread adverse human, material, economic or environmental effects that require immediate emergency response to satisfy critical human needs and that may require external support for recovery
Disaster risk management (DRM)	Processes for designing, implementing and evaluating strategies, policies and measures to improve the understanding of current and future disaster risk, foster disaster risk reduction and transfer, and promote continuous improvement in disaster preparedness, prevention and protection, response and recovery practices, with the explicit purpose of increasing human security, well-being, quality of life and sustainable development (SD)
Disaster risk reduction (DRR)	Denotes both a policy goal or objective, and the strategic and instrumental measures employed for anticipating future disaster risk; reducing existing exposure, hazard or vulnerability; and improving resilience.



Downscaling	A method that derives local- to regional-scale information from larger-scale models or data analyses. Two main methods exist: dynamical downscaling and empirical/statistical downscaling. The dynamical method uses the output of regional climate models, global models with variable spatial resolution or high-resolution global models. The empirical/statistical methods are based on observations and develop statistical relationships that link the large-scale atmospheric variables with local/regional climate variables. In all cases, the quality of the driving model remains an important limitation on the quality of the downscaled information.
Drought	An exceptional period of water shortage for existing ecosystems and the human population (due to low rainfall, high temperature and/or wind)
Early warning systems (EWS)	The set of technical and institutional capacities to forecast, predict and communicate timely and meaningful warning information to enable individuals, communities, managed ecosystems and organizations threatened by a hazard to prepare to act promptly and appropriately to reduce the possibility of harm or loss. Dependent upon context, EWS may draw upon scientific and/or indigenous knowledge, and other knowledge types. EWS are also considered for ecological applications, for example, conservation, where the organization itself is not threatened by hazard but the ecosystem under conservation is (e.g., coral bleaching alerts), in agriculture (e.g., warnings of heavy rainfall, drought, ground frost and hailstorms) and in fisheries (e.g., warnings of storms, storm surges and tsunamis)
Ecosystem	A functional unit consisting of living organisms, their non-living environment, and the interactions within and between them. The components included in a given ecosystem and its spatial boundaries depend on the purpose for which the ecosystem is defined: in some cases, they are relatively sharp, while in others they are diffuse. Ecosystem boundaries can change over time. Ecosystems are nested within other ecosystems, and their scale can range from very small to the entire biosphere. In the current era, most ecosystems either contain people as key organisms or are influenced by the effects of human activities in their environment
Ecosystem services	Ecological processes or functions having monetary or non-monetary value to individuals or society at large. These are frequently classified as (1) supporting services such as productivity or biodiversity maintenance, (2) provisioning services such as food or fibre, (3) regulating services such as climate regulation or carbon sequestration and (4) cultural services such as tourism or spiritual and aesthetic appreciation.
Exposure	People, places, and assets that are in the way of the hazards
Extreme precipitation	High rates of precipitation, resulting in episodic, localized flooding of streams and flat lands
Extreme sea levels	Acute, temporary, and short-term increase of sea levels such as storm surge, astronomical tides, waves and swash
Fluvial flooding	Occurs when rivers and streams exceed their capacity and overflow their banks due to intense or prolonged precipitation



Governance capacity	The ability of governance institutions, leaders and non-state and civil society to plan, coordinate, fund, implement, evaluate and adjust policies and measures over the short, medium and long term, adjusting for uncertainty, rapid change and wide-ranging impacts and multiple actors and demands
Green infrastructure	The strategically planned interconnected set of natural and constructed ecological systems, green spaces and other landscape features that can provide functions and services including air and water purification, temperature management, floodwater management and coastal defence often with co-benefits for human and ecological well-being
Grey infrastructure	Engineered physical components and networks of pipes, wires, roads and tracks that underpin energy, transport, communications (including digital), built form, water and sanitation, and solid-waste management systems
Hard adaptation limit	No adaptive actions are possible to avoid intolerable risks
Hazard	Threats represented by geophysical events and processes that may cause deaths, injuries, damages, loss, and destruction
Health	Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity
Heat index	A measure of how hot the air feels to the human body. The index is mainly based on surface air temperature and relative humidity and thus reflects the combined effect of high temperature and humidity on human physiology and provides a relative indication of potential health risks
Heat stress	A range of conditions in, for example, terrestrial or aquatic organisms when the body absorbs excess heat during overexposure to high air or water temperatures or thermal radiation. In aquatic water-breathing animals, hypoxia and acidification can exacerbate vulnerability to heat. Heat stress in mammals (including humans) and birds, both in air, is exacerbated by a detrimental combination of ambient heat, high humidity and low wind speed, causing the regulation of body temperature to fail.
Human mobility	The permanent or semi-permanent move by a person for at least 1 year and involving crossing an administrative, but not necessarily a national, border
Human security	A condition that is met when the vital core of human lives is protected, and when people have the freedom and capacity to live with dignity. In the context of climate change, the vital core of human lives includes the universal and culturally specific, material and non-material elements necessary for people to act on behalf of their interests and to live with dignity
Increased temperature	Episodic high surface air temperature events potentially exacerbated by humidity
Indigenous Peoples	Indigenous Peoples and Nations are those that, having a historical continuity with pre-invasion and pre-colonial societies that developed on their territories, consider themselves distinct from other sectors of the societies now prevailing on those territories, or parts of them. They form at present principally non-dominant sectors of society and are often determined to preserve, develop and transmit to future generations their ancestral territories, and their ethnic



identity, as the basis of their continued existence as Peoples, in accordance with their own cultural patterns, social institutions and common law system.

Informal settlement	A term given to settlements or residential areas that, by at least one criterion, fall outside official rules and regulations. Most informal settlements have poor housing (with widespread use of temporary materials) and are developed on land that is occupied illegally with high levels of overcrowding. In most such settlements, provision for safe water, sanitation, drainage, paved roads and basic services is inadequate or lacking. The term 'slum' is often used for informal settlements, although it is misleading as many informal settlements develop into good-quality residential areas, especially where governments support such development.
Institutional capacity	Building and strengthening individual organizations and providing technical and management training to support integrated planning and decision-making processes between organizations and people, as well as empowerment, social capital and an enabling environment, including culture, values and power relations
Land cover	The biophysical coverage of land (e.g., bare soil, rocks, forests, buildings and roads, or lakes). Land cover is often categorized in broad land-cover classes (e.g., deciduous forest, coniferous forest, mixed forest, grassland and bare ground). Note: In some literature assessed in this report, land cover and land use are used interchangeably, but the two represent distinct classification systems. For example, the land cover class of woodland can be under various land uses such as livestock grazing, recreation, conservation or wood harvest
Land use	The total of arrangements, activities and inputs applied to a parcel of land. The term land use is also used in the sense of the social and economic purposes for which land is managed (e.g., grazing, timber extraction, conservation and city dwelling). In national greenhouse gas (GHG) inventories, land use is classified according to the IPCC land-use categories of forest land, cropland, grassland, wetlands, settlements and other lands
Land management	The sum of land-use practices (e.g., sowing, fertilizing, weeding, harvesting, thinning and clear-cutting) that take place within broader land-use categories
Livelihood	The resources used and the activities undertaken in order for people to live. Livelihoods are usually determined by the entitlements and assets to which people have access. Such assets can be categorized as human, social, natural, physical or financial
Loss and Damage, and losses and damages	Research has taken Loss and Damage (capitalized letters) to refer to political debate under the United Nations Framework Convention on Climate Change (UNFCCC) following the establishment of the Warsaw Mechanism on Loss and Damage in 2013, which is to 'address loss and damage associated with impacts of climate change, including extreme events and slow onset events, in developing countries that are particularly vulnerable to the adverse effects of climate change.' Lowercase letters (losses and damages) have been taken to refer broadly to harm from (observed) impacts and (projected) risks and can be economic or non-economic



Maladaptive actions (Maladaptation)	Actions that may lead to increased risk of adverse climate-related outcomes, including via increased greenhouse gas (GHG) emissions, increased or shifted vulnerability to climate change, more inequitable outcomes, or diminished welfare, now or in the future. Most often, maladaptation is an unintended consequence
Migration	Movement of a person or a group of persons, either across an international border, or within a state. It is a population movement, encompassing any kind of movement of people, whatever its length, composition and causes; it includes migration of refugees, displaced persons, economic migrants and persons moving for other purposes, including family reunification
Multi-level governance	The dispersion of governance across multiple levels of jurisdiction and decision-making, including, global, regional, national and local as well as trans-regional and trans-national levels
Nature-based solution	Actions to protect, sustainably manage and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits.
Pluvial flooding	Inundation of land and urban areas caused by heavy precipitation, where the excess water cannot be efficiently absorbed or drained due to factors such as impermeable surfaces and inadequate drainage systems
Reforestation	Conversion to forest of land that has previously contained forests but that has been converted to some other use
Risk	Potential loss of life, injury, or destroyed or damaged assets which could occur to a system, society or a community in a specific period of time, determined probabilistically as a function of hazard, exposure, and capacity
Risk assessment	The qualitative and/or quantitative scientific estimation of risks
Runoff	The flow of water over the surface or through the subsurface, which typically originates from the part of liquid precipitation and/or snow/ ice melt that does not evaporate, transpire or refreeze, and returns to water bodies
Sea level rise	Chronic and long-term increase of sea levels considering factors such as steric sea level rise, glaciers, land water storage, ice sheets, and subsidence
Settlements	Places of concentrated human habitation. Settlements can range from isolated rural villages to urban regions with significant global influence. They can include formally planned and informal or illegal habitation and related infrastructure
Shared socio-economic pathways (SSPs)	Shared socio-economic pathways (SSPs) have been developed to complement the Representative Concentration Pathways (RCPs). By design, the RCP emission and concentration pathways were stripped of their association with a certain socio-economic development. Different levels of emissions and climate change along the dimension of the RCPs can hence be explored against the backdrop of different socio-economic development pathways (SSPs) on the other dimension in a matrix. This integrative SSP-RCP framework is now widely used in the climate impact and policy analysis literature (see, e.g., http://iconics-ssp.org), where climate projections



obtained under the RCP scenarios are analyzed against the backdrop of various SSPs. As several emission updates were due, a new set of emission scenarios was developed in conjunction with the SSPs. Hence, the abbreviation SSP is now used for two things: On the one hand SSP1, SSP2, ..., SSP5 is used to denote the five socio-economic scenario families. On the other hand, the abbreviations SSP1-1.9, SSP1-2.6, ..., SSP5-8.5 are used to denote the newly developed emission scenarios that are the result of an SSP implementation within an integrated assessment model. Those SSP scenarios are bare of climate policy assumption, but in combination with so-called shared policy assumptions (SPAs), various approximate radiative forcing levels of 1.9, 2.6, ..., or 8.5 W m⁻² are reached by the end of the century, respectively.

Social infrastructure	Social infrastructure The social, cultural and financial activities and institutions as well as associated property, buildings and artefacts and policy domains such as social protection, health and education that support well-being and public life
Social protection	In the context of development aid and climate policy, social protection usually describes public and private initiatives that provide income or consumption transfers to the poor, protect the vulnerable against livelihood risks and enhance the social status and rights of the marginalized, with the overall objective of reducing the economic and social vulnerability of poor, vulnerable and marginalized group. In other contexts, social protection may be used synonymously with social policy and can be described as all public and private initiatives that provide access to services, such as health, education or housing, or income and consumption transfers to people. Social protection policies protect the poor and vulnerable against livelihood risks and enhance the social status and rights of the marginalized, as well as prevent vulnerable people from falling into poverty.
Soft adaptation limit	Options are currently not available to avoid intolerable risks through adaptive action
Sustainable land management	The stewardship and use of land resources, including soils, water, animals and plants, to meet changing human needs, while simultaneously ensuring the long-term productive potential of these resources and the maintenance of their environmental functions
Transformative adaptation	Actions aiming at adapting to climate change resulting in significant changes in structure or function that go beyond adjusting existing practices which can be adopted at a large scale, leading to new strategies in a region or resource system
Tropical Cyclones	Warm-core low pressure systems associated with a spiral inflow of mass at the bottom level and spiral outflow at the top level
Urbanization	Urbanization is a multi-dimensional process that involves at least three simultaneous changes: (1) land-use change: transformation of formerly rural settlements or natural land into urban settlements, (2) demographic change: a shift in the spatial distribution of a population from rural to urban areas and (3) infrastructure change: an increase in provision of infrastructure services including electricity, sanitation, etc. Urbanisation often includes changes in



lifestyle, culture and behaviour, and thus alters the demographic, economic and social structure of both urban and rural areas

Vector-borne diseases

Illnesses caused by parasites, viruses and bacteria that are transmitted by various vectors (e.g., mosquitoes, sandflies, triatomine bugs, blackflies, ticks, tsetse flies, mites, snails and lice)

Vulnerability

How vulnerable or how much damage potential hazards could do to an exposed area (a product of hazard and exposure)

Water-borne diseases

Illnesses transmitted through contact with, or consumption of, unsafe or contaminated water

Well-being

A state of existence that fulfils various human needs, including material living conditions and quality of life, as well as the ability to pursue one's goals, to thrive and to feel satisfied with one's life. Ecosystem well-being refers to the ability of ecosystems to maintain their diversity and quality.



Abbreviations

A&R	Adaptation and resilience
ACCELERATE	Active Climate Change Engagement Leading to Resilient, Adaptive, and Transformative Empowerment
ADB	Asian Development Bank
AF	Adaptation Fund
AFD	Agence Française de Développement
AMIA	Adaptation and Mitigation Initiative in Agriculture
AR6	Sixth Assessment Report
ARMM	Administrative Region in Muslim Mindanao
ASEAN	Association of Southeast Asian Nations
BARMM	Bangsamoro Autonomous Region in Muslim Mindanao
BAU	Business as usual
BCG	Boston Consulting Group
BFAR	Bureau of Fisheries and Aquatic Resources
CAR	Cordillera Administrative Region
CAT DDO	Catastrophe Deferred Drawdown
CCAP	Cold Chain Association of the Philippines
CCC	Climate Change Commission
CCCAB	Climate Change Commission Advisory Board
CCDR	Climate Change and Disaster Risk
CCET	Climate Change Expenditure Tagging
CDRA	Climate and Disaster Risk Assessment
CFS	Climate-resiliency Field Schools
CGE	Consultative Group of Experts
CHED	Commission on Higher Education
CID	Climatic Impact-Driver
CIN	Climate Investment Network
CLUP	Comprehensive Land Use Plan
CMEMP	Coastal and Marine Ecosystems Management Program
CMIP	Coupled Model Intercomparison Project



COP	Conference of the Parties
CORE	Communities for Resilience
CPAR	Community-Based Participatory Action Research on Climate
CPH	Census of Population and Housing
CRA	Climate-resilient agriculture
CREVI	Comprehensive Roadmap for the Electric Vehicle Industry
CRVA	Climate risk vulnerability assessments
CSO	Civil Society Organization
CWRA	Comprehensive Water Resource Assessment
DA	Department of Agriculture
DA-ATI	Department of Agriculture - Agricultural Training Institute
DA-BAFE	Department of Agriculture - Bureau of Agricultural and Fisheries Engineering
DA-BSWM	Department of Agriculture - Bureau of Soils and Water Management
DAR	Department of Agrarian Reform
DBM	Department of Budget and Management
DENR	Department of Environment and Natural Resources
DENR-MGB	Department of Environment and Natural Resources Mines and Geo-Science Bureau
DepEd	Department of Education
DFA	Department of Foreign Affairs
DFI	Development Financial Institution
DHSUD	Department of Human Settlements and Urban Development
DICT	Department Of Information And Communications Technology
DILG	Department of the Interior and Local Government
DKI	Data and knowledge infrastructure
DND	Department of National Defense
DOE	Department of Economy
DOF	Department of Finance
DOH	Department of Health
DOLE	Department of Labor and Employment
DOLE DILEEP	Department of Labor and Employment Integrated Livelihood and Emergency Employment Program



DOST	Department of Science and Technology
DOTR	Department of Transportation
DPG	Digital public goods
DPI	Digital public infrastructure
DPWH	Department of Public Works and Highways
DRFI	Disaster risk financing and insurance
DRR-CCA	Disaster Risk Reduction and Climate Change Adaptation
DRRM	Disaster Risk Reduction and Management
DSWD	Department of Social Welfare and Development
DTI	Department of Trade and Industry
EBA	Ecosystem-based Adaptation
ENIPAS	Expanded National Integrated Protected Area System
ENSO	El Niño Southern Oscillation
EO	Executive Order
ESG	Environmental, social, governance
EV	Electric vehicle
EVSA	Expanded vulnerability and suitability analysis
FCDO	Foreign, Commonwealth and Development Office
FIES	Family Income and Expenditure Survey
FLEMMS	Functional Literacy, Education and Mass Media Survey
GAA	General Appropriation Act
GAD	Gender and Development
GCF	Green Climate Fund
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse Gas
GI	Governance and Institutions
HEI	Higher education institution
HNRDA	Harmonized National Research and Development Agenda
ICT	Information and communications technology
IP	Indigenous people



IPCC	Intergovernmental Panel on Climate Change
JMC	Joint Memorandum Circular
LCCAP	Local Climate Change Action Plan
LGU	Local Government Unit
LNOB	Leaving No One Behind
M&E	Monitoring and Evaluation
MC	Memorandum Circular
MDB	Multilateral Development Bank
MEAL	Monitoring, Evaluation, Accountability, Learning
MMDA	Metropolitan Manila Development Authority
MRB	Major River Basin
MSME	Micro, small, medium enterprise
NAMRIA	National Mapping and Resource Information Authority
NAP	National Adaptation Plan
NAP-NSC	National Adaptation Plan-National Steering Committee
NBS	Nature-based solution
NCCAP	National Climate Change Action Plan
NCIP	National Commission on Indigenous Peoples
NCR	National Capital Region (Metro Manila)
NCRMF	National Climate Risk Management Framework
NDC	Nationally Determined Contribution
ND-GAIN	Notre Dame Global Adaptation Initiative
NDRRMC	National Disaster Risk Reduction Management Council
NEDA	National Economic and Development Authority
NFRDI	National Fisheries Research and Development Institute
NFSCC	National Framework Strategy for Climate Change
NGA	National Government Agency
NGO	Non-Government Organization
NIASD	National Innovation Agenda and Strategy Document
NICCDIES	National Integrated Climate Change Database Information and Exchange System



NIPAS	National Integrated Protected Area System
NPAAAD	Network of Protected Areas for Agricultural and Agro-Industrial Development
NSHP	National Soil Health Program
NSS	National Spatial Strategy
NWRB	National Water Resources Board
OCD	Office of Civil Defense
ODA	Official Development Assistance
PA	Protected Area
PAGASA	Philippine Atmospheric, Geophysical and Astronomical Services Administration
PAME	Protected Area Management Enhancement
PAP4SCP	Philippine Action Plan for Sustainable Consumption and Production
PAPs	Programs, activities and projects
PAR	Philippine Area of Responsibility
PBBM	Program for Bantay-Peste Brigade and Management
PCB	Programs Convergence Budgeting
PCHRD	Philippine Council for Health Research and Development
PDO	Pacific Decadal Oscillation
PDP	Philippine Development Plan
PEG	Progress, Effectiveness, and Gaps
PES	Payment for Ecosystem Services
PGC	Participatory Governance Cluster
PhilHealth	Philippine Health Insurance Corporation
PhilMech	Philippine Center for Postharvest Development and Mechanization
Phil-WAVES	Philippine Wealth Accounting and the Valuation of Ecosystem Services
PhiVolcs	Philippine Institute of Volcanology and Seismology
PHP	Philippine Peso
PIA	Philippine Information Agency
PIPOL	Public investment program
PNRI	Philippine Nuclear Research Institute
POESA	Philippine Ocean Economy Satellite Accounts



PPCR	Pilot Program for Climate Resilience
PPP	Public-private partnership
PRIME	Pest Risk Identification and Management Efficiency
PSA	Philippine Statistics Authority
PSE	Philippine Stock Exchange, Inc.
PSF	People's Survival Fund
PSFR	Private Sector Facilities for Resilience
PTFCC	Philippine Task Force on Climate Change
R&D	Research and development
RA	Republic Act
RBME	Result Based Monitoring and Evaluation
RBMES	Results-Based Monitoring and Evaluation System
RCP	Representative concentration pathway
RRSP	Risk resiliency and sustainability program
RWHS	Rainwater Harvesting System
S&P	Standard and Poor
SAFDZ	Strategic Agriculture and Fisheries Development Zone
SALINTUBIG	Sagana at Ligtas na Tubig para sa Lahat
SARAI	Smarter Approaches to Reinvigorate Agriculture as an Industry
SCB	Skills and capacity building
SCCF	Special Climate Change Fund
SDG	Sustainable Development Goal
SE	Stakeholder engagement
SEA	Southeast Asia
SEADRIF	Southeast Asia Disaster Risk Facility
SLR	Sea level rise
SMARTSeas	Strengthening Marine Protected Areas to Conserve Marine Key Biodiversity Areas in the Philippines
SNAP	Stocktaking for National Adaptation Planning
SSP	Shared Socioeconomic Pathways
SST	Sea surface temperature



STC4ID	Science and Technology Community-based Program for Inclusive Development
SUCs	State universities and colleges
SWCCO	System-Wide Climate Change Office
TAMD	Tracking Adaptation and Measuring Development
TC	Tropical cyclone
TESDA	Technical Education And Skills Development Authority
TI	Technology and innovation
TWG	Technical working group
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNISDR	United Nations International Strategy for Disaster Reduction
USD	United States Dollar
WAISS	Water Balance-Assisted Irrigation Decision Support System
WEF	World Economic Forum
WNP	Western North Pacific
WQMA	Water Quality Management Area



Executive Summary



Executive Summary

The Necessity and Urgency of Adaptation for the Philippines

The Philippines is among the world's most vulnerable countries to climate change. In 2022, it ranked number 1 out of 193 nations globally on the World Risk Index (WRI) due to its vulnerability to disasters and extreme events. The country faces exposure to catastrophic extreme events, such as floods, droughts, and extreme sea levels, and slow onset events, including increased temperatures and sea-level rise. One such example of a catastrophic event is the 2013 Super Typhoon Haiyan (Yolanda), a category five storm and one of the most powerful tropical cyclones ever to hit landfall. This typhoon holds the record of being both the deadliest and costliest natural disaster in the country's recent history, resulting in approximately 6000 fatalities, 1000 missing persons, 29,000 injuries and an estimated USD 13 billion in damages. The catastrophe was attributed to a range of factors, including the thermodynamic effects on extreme sea surface temperatures, rising sea levels, and the storm surges associated with climate change, all of which significantly heightened the typhoon's overall impact.

Recent events vividly demonstrate the increasing magnitude and frequency of climate related events to the nation. In July 2023, Super Typhoon Doksuri (Egay) wreaked havoc, bringing a staggering 0.5 meters of rainfall and affecting nearly 600,000 people across 45 provinces. This devastating weather event caused substantial damage to key sectors of the economy, particularly agriculture and livestock. The estimated cost of the damages inflicted by the typhoon stands at PHP 800 million, with infrastructure losses reaching PHP 1.2 billion. In September 2023, Casiguran in Aurora witnessed an all-time high heat index for the country, hitting a historic record of 60°C. This extreme heat pushed the town's heat index into the 'Extreme Danger' category, greatly increasing the risk of heat-related illnesses. These incidents, among many others, serve as stark reminders of the pressing need for climate action and adaptation measures in the Philippines. This urgency is compounded by the country's status as a developing nation with a significant number of vulnerable populations, while possessing abundant natural assets and biodiversity in need of protection.

Climate change presents a complex and multifaceted threat to the Philippines. Economically, it inflicts significant harm by escalating the frequency and intensity of climate-induced events, resulting in the need for costly disaster responses, infrastructure repairs, and other economic repercussions such as business disruptions and reduced productivity of the workforce. Despite being a relatively minor contributor to global warming, the economic toll of climate change on the Philippines is substantial. According to the Philippines Country Climate and Development Report, by 2030, climate change is projected to impact 7.6% of the total GDP of the country, amounting to PHP 1.4 trillion, and rising to 13.6% by 2040. Climate analytics conducted suggest that the cost of inaction will stem primarily from infrastructure damage due to climate-induced disasters (up to PHP 365 billion), productivity losses caused by extreme heat (up to PHP 466 billion), business interruptions (up to PHP



527 billion), and relocation-related costs (up to PHP 8.9 billion) for communities displaced by climate events. These adverse effects are expected to intensify by 2050, potentially increasing to 18% to 25% of GDP.

Socially, climate change has a severe impact on the population, particularly among vulnerable groups in the Philippines as they bear the brunt of climate-induced displacement, livelihood loss, and heightened inequality. Additionally, there is an increased risk of health issues among the population due to rising temperatures, which can lead to heat-related illnesses such as heat stroke and cardiovascular stress. Changes in rainfall and temperature patterns also expand breeding grounds for vector-borne diseases like dengue fever and leptospirosis. Climate-induced mobility is also a growing concern as communities in vulnerable regions are compelled to migrate internally or internationally in search of improved living conditions, often without the proper support mechanisms to ensure safety and security.

From a natural perspective, the Philippines is one of the 18 mega-biodiverse countries globally, ranked third in terms of marine biodiversity and home to over 25,000 endemic species. The Philippines's biodiversity is at significant risk due to changing ecosystems and habitats, endangering unique species and the critical fisheries sector. Natural assets such as forests, mangroves, and coral reefs, which provide substantial ecosystem services to the local community and the world, are at risk for destruction. To-date, recurring issues which threaten biodiversity are observed such as forest fires, degraded mangroves, and coral bleaching.

As temperatures continue to rise at rates surpassing global averages, the potential impact on the Philippines becomes increasingly dire. Four climatic-impact drivers hold significant implications for the nation: Increased temperature and droughts, Sea level rise, Extreme Sea levels, Extreme precipitation, and Wind patterns and Tropical cyclones. If the world continues along its current path, and the Intergovernmental Panel on Climate Change (IPCC) 'worst-case' scenario, SSP5-8.5, becomes a reality, the Philippines could face the following in the next 3 decades:

- Increased temperatures and droughts: The number of Filipinos potentially impacted by extreme heat (i.e., at heat indices that are greater than 42°C), is projected to reach up to 11 million by 2030 and may increase to 74 million by 2050. A heat index above 42 degrees is classified as 'Danger', where heat cramps, exhaustion and heat stroke are probable with continued exposure. Moreover, productivity loss due heat stress may reach up to PHP 466 billion within the 2030 decade and soar to PHP 870 billion within the 2050-decade, equivalent to 3% and 5% GDP in 2030 and 2050, with outdoor sectors such as Agriculture and Construction most affected. Furthermore, drought has a substantial impact on the well-being of biodiversity leading to the death of plants and animals, and devastation to other natural assets such as coral bleaching.



- **Sea level rise:** The rate of sea level rise (chronic and long-term increase of sea levels considering factors such as sterodynamic sea levels, glaciers, land water storage, icesheets, and subsidence) will exceed the global average, possibly doubling by 2060. Approximately 150,000 Filipinos may face permanent displacement due to sea-level rise by 2040, with potential economic losses of PHP 18 billion. Sea level rise will also affect natural systems and cause impacts such as mangrove degradation, coral reef bleaching and saltwater intrusion.
- **Extreme sea levels:** Extreme Sea levels (acute, temporary, and short-term increase of sea levels such as storm surge, astronomical tides, waves, and swash) may also intensify, potentially increasing by 35% within the 2030 decade resulting in up to 2 million Filipinos impacted and PHP 80 billion at stake from extreme sea levels.
- **Extreme precipitation:** Rainfall patterns will become more extreme, causing intensified rainfall throughout the year especially in the eastern sections of the country. Within the 2030 decade, up to 4.8 million Filipinos may be affected by pluvial flooding (flooding due to excessive rainfall overwhelming local drainage capacity) and an additional 250,000 impacted by fluvial flooding (flooding due to overflowing rivers and water streams). Further, potential losses of PHP 274 billion from pluvial flooding and PHP 13 billion from fluvial flooding pose an economic risk due to extreme precipitation. Not to mention, a large percentage of those exposed to pluvial flooding (18%) are in the lower income groups and may not have the capacity to prepare for these challenges.
- **Wind patterns and tropical cyclones:** While the frequency of typhoons may decrease in a warmer world, their intensity will significantly increase, with the average maximum wind speed of typhoons and super typhoons increasing by 29% within the 2030 decade and 33% within the 2050 decade. About 6 million Filipinos may face more than one TC occurrence exceeding 118 km/h (typhoon and/or super typhoon), translating to about PHP 83 billion and PHP 78 billion in infrastructure damage by 2030 and 2050.

In this convergence of economic strain, social vulnerability, and ecological disruption, climate change is expected to exact a heavy toll on the Philippines. This underscores the urgent need for climate action, adaptation and resilience-building efforts to ensure the sustainable development and well-being of the country and its population.

The Philippine government acknowledges the significant challenges posed by climate change and has taken action to address these effects, adopting major international conventions and translating these commitments into national policies and programs across various sectors. The establishment of the Climate Change Commission (CCC) as the leading policy-making body, tasked with coordinating, monitoring, evaluating, and ensuring the mainstreaming of climate change considerations into national, local, and sectoral development plans, in collaboration with various



stakeholders, exemplifies the country's commitment to addressing climate issues. However, large challenges remain to pursue transformative development pathways.

To facilitate effective mid and long-term adaptation planning and enable the integration of adaptation into relevant policies and programs, the Philippines initiated its National Adaptation Plan (NAP) process in 2023. Formulating this NAP is a major step in the country's commitment to building adaptive capacity through the whole of government and society approach. It creates a guideline for comprehending climate risks in the Philippines based on the best available climate science and analytics. This data-driven approach is then supported by the identification of adaptation strategies and the necessary enablers to mobilize action. The NAP is expected to be further refined and downscaled to serve as an impetus to mobilize the resources and financing required for the Philippines to adapt and build resilience against the impacts of climate change. Ground-level actions consistent with the science-policy-action continuum, supported by sufficient investments and capacities, are at the core of long-term climate change planning towards low carbon, inclusive, and sustainable and transformative development directions for the Filipino people.

The NAP Vision, Objectives and Approach

The vision of the Philippines National Adaptation Plan (NAP) is to establish the country's adaptation priorities at a national level, with the goal of enhancing adaptive capacities and increasing resilience in communities, ecosystems and the economy against natural hazards and climate change. It aims to steadily reduce climate-related losses and damages while optimizing opportunities for mitigation, thus facilitating transformative adaptation, while fostering resilient, sustainable development.

The objective of the NAP is to reduce the country's vulnerability to climate change impacts by bolstering adaptive capacity, fostering resilience, and integrating adaptation into relevant policies and programs. It strives to define an adaptation pathway that incorporates sectoral and national development priorities, providing guidance for effective public spending, accessing multilateral funding, and attracting private capital for adaptation efforts.

The following approach and guiding principles have been applied in the development of the NAP:

- The NAP has been developed in compliance with UNFCCC guidelines and localized to the unique challenges and characteristics of the Philippines.
- It places a strong emphasis on a data-driven approach, utilizing best available climate science and analytics at the time of writing to better understand the potential impacts of climate change, thus supporting more informed design making in the future.



- The plan builds upon existing knowledge and mechanisms within the Philippines today, recognizing ongoing efforts at different levels that contribute to adaptation and the need for consolidation, streamlining and continuous iteration.
- The NAP promotes active and participatory stakeholder involvement and has been developed through extensive consultations, including national expert consultations and workshops. It has benefited from the collective knowledge, experience, and ownership of diverse stakeholders across the country to ensure collaboration and collective ownership.
- The NAP focuses on analysis and strategies at the national level, which will then need to be further downscaled at local and sectoral levels.

Adaptation Strategy & Priorities

To effectively build resilience to minimize climate-related loss and damage and increase adaptive capacity towards the transformation of resilient and sustainable socioeconomic development, **eight key sectors have been selected as the focal points for adaptation action:**

1. Agriculture & Fisheries & Food Security
2. Water Resources
3. Health
4. Ecosystems and Biodiversity
5. Cultural Heritage, Population Displacement and Migration
6. Land Use and Human Settlements
7. Livelihoods and Industries
8. Energy, Transport & Communications

While adaptation priorities in this NAP are outlined per sector, the NAP also recognizes the inextricable links between various sectors and emphasizes the need for an integrated approach to adaptation. Disruptions in any of these sectors can trigger cascading impacts on other interrelated systems. The NAP emphasizes the value of these interconnected benefits, promoting a synergistic approach that maximizes the co-benefits across sectors to build a more resilient and adaptive Philippines.

There are five thematic cross-sector adaptation strategies that the Philippines will focus on. These themes are reflected in respective sector-specific adaptation strategies expounded on below.

1. *Strengthen infrastructure resilience:* This strategy focuses on reinforcing critical infrastructure across various sectors to withstand adverse impacts and minimize disruption of services caused by climate change impacts.



2. *Safeguard livelihoods with social protection and regulations:* This strategy focuses on actions and mechanisms that safeguard the livelihoods of populations from the impacts of climate change through social safety nets and climate-responsive regulations.
3. *Empower local governments and communities to take adaptation action:* This strategy involves enabling local governments and communities to implement adaptation solutions by mainstreaming understanding of adaptation and resilience and sufficiently capacitating them with access to climate data, resources, and tools.
4. *Mainstream integrated adaptation governance:* This strategy articulates the importance of fostering a coordinated collaboration among stakeholders, policymakers, and institutions across horizontal and vertical chains of command on adaptation priorities.
5. *Scale up nature-based solutions:* This strategy emphasizes the importance of prioritizing the usage of nature-based solutions where possible, to drive climate resilience and protect vulnerable populations.

Best-available climate analytics, considering physical, social, and economic dimensions, was used to understand the potential impact of climate change to each sector. The following sections below provide an overview of the sector-specific contexts, historical and future projected climate change impacts, and consequently, priority adaptation outcomes.

1. Agriculture & Fisheries & Food Security:

The production of crops, livestock, aquaculture, and fishery systems in the Philippines is critical to food security as 75% of food consumed in the country is locally produced. Additionally, agriculture is a significant sector for the economy, most recently contributing 9% to GDP while employing a quarter of the nation's workforce. However, the sector faces key challenges across resource bases, labor, capital, productivity, and policy, which have led to farmers and fisherfolk having the highest poverty incidence rates in the Philippines, at 30% and 30.6%, respectively as of 2021.

Agriculture and Fisheries have historically been one of the most vulnerable sectors to climate change and will continue to be severely impacted in the coming decades if no action is taken. Increased temperature and drought and erratic rainfall are projected to reduce yield across crops, livestock and fishery catch – between 2030 and 2040, declines in yield of 6% and 19% are projected for rice and corn, respectively. At the same time, cyclones and extreme rainfall will damage farmland and fishponds, with 7.5% of agricultural land projected to be exposed to pluvial floods, 15% of fishponds projected to be exposed to extreme sea levels across the decade



of 2030. These impacts, combined with the high poverty incidence rate and proximity to the coastline in the case of fisherfolk, compound the vulnerabilities faced by Filipinos who depend on agriculture, aquaculture, and fisheries as their source of livelihood.

With these pressing impacts in mind, the adaptation theme for Agriculture and Fisheries & Food Security is **Securing Food Supply: Nurture Nature, Sustain Livelihoods**. Strategies identified in this NAP aim to achieve three key outcomes:

1. Productive and resilient agriculture and fisheries achieved
2. Natural resources critical for agriculture, aquaculture, and fisheries conserved
3. Farmers' and fisherfolk's livelihoods secured amidst climate change.

2. Water Resources:

Water resources are essential for human survival as well as economic activity, supporting agricultural irrigation, fisheries production, hydropower generation, and industrial production. A rapidly growing population without appropriate planning and investment into water systems has led to national water stress levels twice of the global average – 12.4 million (12%) Filipinos lacked basic access to drinking water in 2015, while 26 million did not have access to basic sanitation. This situation may be further exacerbated by the impacts of climate change, leading to cascading impacts to other sectors such as health, where contaminated water sources are a major source of waterborne diseases in the Philippines.

The current state of Philippine water supply and quality, combined with its water infrastructure network make the nation's water resources particularly vulnerable to climate change. Drier dry seasons are likely to worsen the conditions across localities already experiencing symptoms of water stress – Region VII, for example, is projected to receive over 400mm less rainfall per year between 2030-40 versus 1991-2020, despite already facing a combination of absolute water scarcity level of water availability per capita per year and a third of its population without access to a safe water source. On the other hand, wetter wet seasons and more intense cyclone damage may affect water infrastructure – for example, in 2009, the impact of Typhoon Ketsana (Ondoy) on water infrastructure led to a 92% decrease in water supply capability. This is expected to continue across the decade of 2030-2040, where almost 10% of water infrastructure, composed of water tanks and towers, dams, and treatment plants, are projected to be exposed to pluvial floods and cyclones leading to direct damages of over PHP 11 billion annually.



With the vulnerabilities that both built and natural water sources face across the nation, the adaptation theme for Water Resources is **Safeguard Water Security: Secure and Sanitary Water for All**. Strategies identified in this NAP aim to achieve three key outcomes:

1. Resilience built into water infrastructure
2. Water supply and quality protected from shifts in weather patterns
3. Watersheds and surrounding ecosystems are protected and properly managed.

3. Health:

More than 110 million Filipinos rely on the healthcare system to effectively anticipate, respond, and recover from climate-related disasters and climate-induced diseases. With only 56% of public health facilities sufficiently stocked with selected essential medicines and less than 25% of cities and municipalities having health worker density above internationally recommended levels, the capacity of the health sector to respond effectively to sudden and increased healthcare demands is limited, disproportionally impacting low-income populations who cannot afford private healthcare.

Compounding existing health inequalities, climate change has both direct and indirect impacts on human health. Directly, exposure to extreme weather events may result in increased incidences of vector-borne diseases, waterborne diseases, and heat-related illnesses. For example, contaminated water brought about by poor drainage systems after heavy rainfall may contribute to increases in leptospirosis incidences in the 2030 decade, projected to grow by 58% versus historical incidences, thus risking mortality of Filipinos. Indirectly, health networks and health infrastructure may be damaged by climate risks. By the next decade, a projected 8% of critical healthcare infrastructure will be exposed to pluvial floods, especially impacting primary healthcare facilities in the Philippines that are not built to withstand extreme climate events. Reliability of interoperable information systems and a strong health governance will be critical to activate to ensure continuity in maximizing health outcomes.

Built on the vision of activating a holistic approach to improve health outcomes, reduce health inequalities, and achieve universal healthcare, supported by current programs and policies that help address social determinants of health, the adaptation theme for this sector is **Climate-Adaptive Healthcare for All: Protecting Health & Well-Being of Filipinos**. Strategies identified in this NAP aim to attain four key outcomes:

1. Minimized patient mortality from climate-sensitive diseases through reinforced primary care and reinforced community health workers



2. Seamless access to climate-responsive health services underpinned by resilient health networks
3. Interoperable information system to monitor and evaluate health vulnerability and capacity developed
4. Resilient, interconnected and community-driven health governance at all levels.

4. Ecosystems & Biodiversity:

The Philippine ecosystem makes it one of the 18 mega-biodiverse countries in the world, while also providing livelihood and value across key industries locally such as aquaculture, agriculture, fisheries, and tourism, and protecting surrounding communities from climate hazards. In particular, the Philippines's coral reefs (~70k PHP/ha annually), forests (~200k PHP/ha annually), and mangroves (~200k PHP/ha annually) have been estimated to generate billions of pesos in ecosystem services annually. These ecosystems have been heavily exploited over the past decade due to both manmade developments and climatic-impact drivers, putting both themselves and the communities who depend on them for livelihood and protection at risk.

Ecosystems across the world are particularly vulnerable to climate change, and the Philippines is no exception. The intensification of severe weather events could lead to the deterioration of habitats and disruption of ecological balance, further endangering various species. For example, sea level rise, which has been known to drive the retreat or disappearance of mangrove forests, may affect 32% and 48% of mangroves in the nation in the decades of 2030 and 2050 respectively. Rising temperatures, which are by far the most threatening climate impact driver for coral reefs, may impact 19% of Philippine coral reefs over the course of the 2030 decade. Lastly, over a third of Philippine forests, which are particularly vulnerable to extreme rainfall and the flooding caused by it, are projected to be exposed to pluvial and fluvial floods, with the same exposure potentially increasing to close to 50% in the decade of 2050.

Grounded in national policies and existing programs aiming to maximize and sustain the value ecosystems generate for the nation, the adaptation theme for Ecosystems & Biodiversity is **Safeguard Biodiversity: Restore Natural Assets**. Strategies identified in this NAP aim to attain three key outcomes:

1. Ecosystems accounts developed and regularly updated to monitor and enhance regulating services for adaptation
2. Protected and rehabilitated biodiversity across habitats and ecosystems
3. Enabled and empowered communities to lead ecological management.



5. Cultural Heritage, Population Displacement and Migration:

Extreme climate events and risks will continue to affect migration patterns in the country.

More than 15 million Filipinos were estimated to be displaced by 245 climate disaster events from 2020 to 2022. Especially vulnerable to displacement and migration caused by sudden-onset climate events (e.g., typhoons, etc.) and slow onset climate risks (e.g., rising sea levels, etc.) are 14 - 17 million indigenous people (IP) that inhabit the Philippines, belonging to 110 different ethnolinguistic groups, with 73% of all IPs belonging to 40% poorest of the population. Addressing climate-induced human mobility with a lens of cultural heritage preservation is critical in planning for adaptation measures for the Philippines.

Climate change poses large threats to the well-being of migrants and indigenous peoples.

Among the various climatic-impact drivers, cyclones and pluvial flooding are projected to affect the largest magnitude of populations. In the 2030 decade, an estimated 5.3 million people per year will be exposed to at least one Category 4 or Category 5 cyclone, of which 11% are impoverished populations who have limited resources to resist, adapt or recover from voluntary or involuntary migration. Displacement of indigenous communities from their cultural lands impact their way of life significantly, as land is integral to their cultural identity, livelihoods, spiritual practices, social structures, and traditional knowledge systems. Migration due to slow onset climate events such as sea level rise is also a key climate risk that will impact this sector. In the 2030 decade, an estimated 150,000 Filipinos per year may be exposed to sea level rise.

With expectations of increased instances of climate-induced human mobility, the adaptation theme for this sector is **Safeguarding Communities & Culture: Durable Solutions for Climate-Induced Mobility**. Strategies identified in this NAP aim to attain three key outcomes:

1. Provision of adaptive physical, social, and economic support to populations displaced by sudden climate events
2. Robust preparatory and reintegration support in place for populations impacted by slow-onset climate events
3. Cultural heritage preservation, protection and rehabilitation safeguards established amidst climate risks.

6. Land Use and Human Settlements:

Land use and human settlements play a vital role in the development and sustainability of the Philippines. With 60% of Philippine cities located along the coast, the country's coastal areas



and low-lying regions are especially susceptible to climate risks, where an estimated 5.4 million Filipinos live. In addition, rapid urbanization has contributed to divergences to planned land use and an increase in informal settlements in hazard-prone areas. As a result, this sector today faces a myriad of challenges relating to capacity, land use, access to shelter and services, connectivity, equity, and justice.

Escalating climate change directly jeopardizes land and human settlements. By 2040, a projected 160 km² of land will be permanently inundated by sea level rise. This translates to an estimated 85,000 residential homes inundated by rising sea levels, many of which unaccounted for are informal settlements and coastal communities. Cyclones and pluvial flooding are also among the climatic-impact drivers that may threaten land use and human settlements. More than 80% of land (180 000 km²) is projected to be exposed to at least one Category 4 or Category 5 cyclone in both the 2030 decade and 2050 decade, while more than 55% of land is projected to be exposed to pluvial flooding in the 2030 decade, impacting about 170,000 km² of land. As such, it will be critical to transform the Philippines' approach to land use and settlements planning, powered by a transformative multi-level governance, and with a strong focus on increasing adaptive capacities of communities to withstand these climate risks.

Grounded in national policy anchors and existing programs related to this sector, the adaptation theme for this sector is **Data-Driven Land Use & Settlements: Conventionalizing Robust, Evidence-Based Planning**. Strategies identified in this NAP aim to attain three key outcomes:

1. Data-driven, climate-focused land use and urban planning established
2. Increased adaptive capacities of communities achieved
3. Activated transformative multilevel climate governance.

7. Livelihoods & Industries:

Resilience in key industries in the Philippines must be built to protect the country's economic and social stability amidst increasing climate hazards and risks. Key industries that contribute heavily to the Philippines' GDP must be protected, particularly the Manufacturing (17.2%), Tourism (6.2%), and Professional Services (6.1%) sectors, thus safeguarding the livelihood of over 12 million Filipinos who rely on these industries. Focus is placed to protect MSMEs, who make up more than 95% of establishments in the Philippines, and often have fewer capacities to invest in climate-resilient infrastructure, technology, and adaptation measures.



Climate change has wide-ranging impacts on key industries, in turn impacting stability of livelihoods of Filipinos. For example, in the manufacturing industry, critical industry infrastructure can be inundated or damaged by extreme weather events, leading to disruptions in production and supply chains. 6% of manufacturing infrastructure is projected to be exposed to cyclones and extreme winds in the 2030 decade. Beyond costs due to physical damage, production and supply chain disruptions, equipment loss and workforce disruption also threaten the stability of this sector. Similar exposure is expected for professional services infrastructure (5%) and tourism infrastructure (5%). Increased temperatures and drought are also projected to impact labor productivity in these key sectors. For the manufacturing industry, PHP 36 billion in productivity losses is projected, while an additional PHP 2 billion in productivity losses is projected for professional services. Beyond productivity losses, damage to industry infrastructure and consequent disruptions in operations, it is imperative to consider the impact to livelihoods and well-being of Filipino workers. The continuity of industries is intrinsically linked to the stability of employment opportunities, income streams, and social support systems that sustain the workforce.

In line with the long-term Philippines' vision to revitalize industry and reinvigorate services, the adaptation theme for this sector is **Embrace Resilience: Fortifying Industry for Economic Prosperity**. Strategies identified in this NAP aim to attain three key outcomes:

1. Key industry infrastructure and production facilities protected
2. Due diligence in regulations and worker protections enhanced for climate-resilience of workers
3. Continuity of industry operations and productivity sustained amidst climate risks.

8. Energy, Transport, and Communications:

Infrastructure such as energy, transport, and communications make up critical systems that empower and interconnect industries, businesses, and households, facilitating economic activities and growth while providing communities with access to essential services. Rapid economic and population growth combined with poorly implemented programs have led to overloaded infrastructure systems resulting in the Philippines having 1/3 the average kWh per capita, as well as among the highest people to telecom tower ratio at over 6000. The infrastructure systems are also among the most vulnerable to climate change across the world, putting the various communities and organizations that depend on these services at risk. Future climate change may also change the demand required for these infrastructure services and it is critical to balance adaptation efforts with mitigation efforts given that current energy and transport systems are major emitters of greenhouse gases.



Climate change will further exacerbate vulnerabilities within the Energy, Transport, and Communications sector, as it impacts both the infrastructure of these services and influences the demand profile for services across these systems. On the side of infrastructure, 8% of energy infrastructure, composed of electric lines and poles, substations, and generators, is projected to be exposed to extreme climate events, resulting in over PHP 3 billion of direct damages annually across the 2030 decade. An estimated 5% of roads, bridges, railways, airports, seaports, and other transport terminals are projected to be exposed to climate hazards in this same decade, resulting in ~PHP 37 billion of direct damages per year. Lastly, 15% of communications infrastructure, composed of telecom towers and data centers, are projected to be exposed to climate hazards causing direct damages of PHP 350 million annually from 2030-40. Beyond infrastructure, increased temperature and drought are expected to influence the demand profile for services provided by these systems, while potentially reducing efficiency of infrastructure, evidenced by instances such as the 2019 heatwave which caused shortages due to reduced cooling capacity of the Calaca Coal-fired power plant.

Grounded on national policies and existing programs aiming to ensure secure access to the services provided by these infrastructure systems amidst climate change, the adaptation theme for Energy, Transport, and Communication is **Protect Critical Assets: Securing Access & Socioeconomic Connectivity**. Strategies identified in this NAP aim to achieve two key outcomes:

1. Comprehensive planning and response mechanisms established across energy, transport, and communication infrastructure
2. Sufficient capacity of energy, transport, and communication infrastructure services to meet evolving demand induced by climate change.

A broad estimation of the impacts across the climatic-impact drivers to each sector was conducted to identify the optimal timing and approach that the Philippines should adopt in addressing adaptation measures.

The economic cost of inaction, estimated at PHP 645 billion/ per year across these eight sectors, is evident. Four of the eight sectors, including **Land Use and Human Settlements, Energy, Transport and Communications, Livelihood and Industries, and Agriculture and Fisheries**, have economic costs of inaction sizeable enough to spur action. **For these sectors, the case for taking adaptive measures is clear: there is a compelling need to accelerate efforts to mitigate the cost of inaction.**

However, it is equally crucial to consider other indirect, social costs of inaction, such as health impacts, loss of ecosystem services, conflict and security risks and psychological and social stress. While these costs are not comprehensively quantified within socioeconomic models, a comprehensive assessment



might reveal that these indirect consequences can be equally, if not more, detrimental to the Philippines. For sectors such as **Water Resources, Cultural Heritage, Population Displacement and Migration, Ecosystems and Biodiversity and Food Security**, the approach to adaptation action may differ on top of adaptation actions, there is a **need for next-level impact assessments to trace pathways by which initial climate change impacts trigger secondary and tertiary consequences.**

Additionally, key considerations must be integrated as the adaptation priorities are downscaled. One, adaptation strategies in this document are crafted at a national level and are intended to be tailored to the specific contexts of regions and localities, aligning with localized projected climate impacts. Two, the NAP recognizes the critical importance of integrating sectoral adaptation strategies as a cornerstone of effective climate resilience planning. Isolated sectoral approaches may lead to unintended consequences and potential maladaptation, where efforts in one sector inadvertently undermine progress in another. Lastly, beyond considerations of maladaptation, localized adaptation implementation also needs to consider soft and hard limits. Emphasizing the recognition of the spectrum of adaptation actions is not only essential for enhancing the nation's resilience to climate change but also for harnessing co-benefits with climate mitigation efforts.

Implementation

Given the NAP's ambitious agenda to create climate resilience in the Philippines, implementation will be complex and require a whole of country approach. Collaboration, coordination, and participation will involve various government agencies, levels of government, sectors, and stakeholders.

To ensure effective implementation, six key enablers have been identified as key for success in the Philippines:

1. **Governance & Institutions:** Establishing a purpose-fit governance structure to oversee the NAP and integrate adaptation seamlessly into existing plans, policies, and strategies. This ensures a whole-of-government approach, enhancing accountability, ownership, and optimizing resource allocation.
2. **Stakeholder Engagement:** Identifying and engaging all relevant actors crucial to the NAP's success, including the private sector, local communities, and at-risk groups such as indigenous populations, the elderly, youth, and lower-income groups. It is also emphasized that the NAP is gender-responsive and promotes women's empowerment in climate action. This ensures that the NAP emphasizes inclusivity, collaboration, meaningful engagement, and effective outcomes.



3. **Skills & Capacity Building:** Assessing the skills and capacity gaps among those responsible for advancing the NAP and addressing these gaps through capacity building and knowledge sharing. Capacity building extends to human, institutional, financial, and organizational capacities.
4. **Data & Knowledge Infrastructure:** Establishing a robust foundation of data and knowledge critical for an effective NAP process. This facilitates a comprehensive understanding of exposure, enabling the prioritization of impactful strategies.
5. **Technology & Innovation:** Continuously advancing technology and innovation to address the consequences of climate change. This involves localizing global technology and innovation to suit the Philippines' context and scaling up local solutions beyond specific use cases.
6. **Adaptation Financing:** Deploying effective strategies to secure, allocate, and optimize diverse financial resources while balancing considerations such as climate justice, the country's development goals, and the prevailing financial constraints is crucial. While sources such as domestic public funding, international development funding and private sector might be readily identifiable, several obstacles such as information gaps, limited bankability, and capacity gaps and inadequate policies hinders the progress of adaptation financing today.

Considering the urgency of adaptation in the Philippines, as well as the identified adaptation priorities and necessary enablers, the implementation roadmap for the National Adaptation Plan (NAP) has outlined the following key initiatives needed:

1. Clearly define roles, responsibilities, and institutional arrangements for the NAP to mainstream A&R in the national agenda.
2. Enhance stakeholder engagement and communication strategies to amplify NAP awareness and understanding, and to support gender mainstreaming in adaptation.
3. Downscale climate analytics and enhance adaptation data management and application to support more informed decision making.
4. Translate adaptation strategies into a sectoral-level program/project portfolio, prioritizing based on social, economic, and ecosystem benefits for informed decision-making.
5. Develop a national adaptation investment strategy to mobilize resources needed for adaptation programs.
6. Translate adaptation strategies into a provincial-level program/project portfolio, prioritizing based on social, economic, and ecosystem benefits for informed decision-making.
7. Enhance capability building, research, and innovation on the topic of climate change adaptation.
8. Develop an effective MEAL system for climate change adaptation.



Summary

As a nation that has long grappled with the devastating impacts of climate change, prioritizing climate adaptation stands as an urgent and immediate necessity. The Philippines' NAP represents a foundational framework for fostering a climate-resilient and prosperous future for the nation. It serves as a resounding call to action, urging all stakeholders to unite and chart a transformative course in the face of climate challenges. Prioritizing adaptation and implementing the strategies outlined in the NAP enables the Philippines not only to manage mounting risks but also to harness limited yet tangible opportunities for sustainable economic growth and social development.

The Philippines encourages the active support of other nations, financial institutions, philanthropic organizations, and other stakeholders to support these efforts through the contribution of resources, expertise, and financial support to the adaptation agenda. This call to action is in alignment with the principles of climate justice and echoes a fundamental reality: the fight against climate change is a collective effort, and together, we can construct a more resilient future for our planet, its inhabitants, and the generations to come. An adaptation plan for the Philippines is, in essence, an adaptation plan for the resilience of the world.



Introduction



Introduction

This document is the outcome of the Philippines' National Adaptation Plan (NAP) and process. It provides a broad understanding of the potential socioeconomic and physical impacts of climate change on the Philippines, outlines the country's adaptation priorities and presents a high-level roadmap for implementation.

Chapter 1: This chapter introduces the background and significance of the NAP for the Philippines, and how it aligns with the country's existing climate change policies and frameworks. It defines the purpose, vision, and objectives of the NAP and introduces a logical framework that explains the key outcomes in terms of adaptation and resilience for the country. Additionally, it describes the process by which the NAP was developed and the guiding principles behind its creation.

Chapter 2: This chapter provides an overview of the Philippines' national circumstances, including its geographical features, population, economy, and governance structures. These factors are essential nuances to consider when considering and discussing adaptation and resilience strategies for the country.

Chapter 3: In this chapter, we explore the impacts of climate change on the Philippines. It presents both a historical perspective on observed climate change in the country and offers insights into potential future climate scenarios based on the best available climate science and analytics at the time of study. This analysis helps us better understand the potential socioeconomic consequences of climate change for the country, and the geographical areas within the Philippines which are most impacted.

Chapter 4: Focusing on the most critical sectors for the Philippines as identified in the NAP logical framework, this chapter outlines adaptation priorities for the country. For each sector, the significance of the sector to the Philippines is explored, the challenges posed by climate change are explained, and various adaptation strategies tailored to each sector's needs are defined.

Chapter 5: This chapter outlines the implementation arrangements necessary for the success of the NAP. It includes key enablers required to drive the NAP forward, a high-level implementation roadmap, and outlines future monitoring and evaluation mechanisms required to effectively track progress.

A supplementary Appendix document accompanies insights to this main document. This contains detailed information on climatic-impact driver model methodologies, validation, and references, sector-specific programs and policies aligned with NAP development, stakeholders consulted in the NAP development process, methodologies used for sector-specific impact models, and references to international frameworks and standards.



It is important to note that that this is the first NAP for the Philippines and developed at a national level. Downscaling the analysis and strategies to a more granular level, both geographically and sectorally, will be crucial as the Philippines continues to further progress on its adaptation agenda. This NAP will continue to evolve and be refined as more insights are gathered and lessons learned.



Multidecadal NAP Logical Framework/ Roadmap

Chapter

01



1. Multidecadal NAP Logical Framework Roadmap

1.1 NAP purpose, vision, objectives, and logical framework

1.1.1 Purpose

The Intergovernmental Panel on Climate Change (IPCC)¹ in its Sixth Assessment Report (AR6) underscores the importance of strengthened adaptation to benefit the most vulnerable in an increasingly warming planet. Adaptation planning and implementation are therefore critical for the Philippines as a country ranked consistently high among those at risk to climate change and disaster impacts.

As early as 2010, the Conference of the Parties (COP16)² to the United Nations Framework Convention on Climate Change (UNFCCC) had established the Cancun Adaptation Framework to guide countries in adopting National Adaptation Plans (NAPs) “as a means of identifying medium- and long-term adaptation needs and developing and implementing strategies and programs to address those needs.” Under the Paris Agreement³ Parties are encouraged to undertake the process of NAP formulation and implementation in consideration of vulnerable peoples, places, and ecosystems. The NAP is both a “document” and a “process” to be lodged before the UNFCCC Registry, necessitating regular tracking and updating based on the cycle of planning, monitoring, and evaluation, as may be driven by lessons learned, progress, and effectiveness of early implementation, and feedback, anchored on the best available science and unique national circumstances.

The main objectives of the NAP are to reduce vulnerability to the impacts of climate change by building the adaptive capacity and resilience of communities and to facilitate the coherent integration of climate change adaptation into relevant new and existing policies, programs, and activities. The NAP should mainstream adaptation across as many sectors as possible and at different levels (national, subnational, regional, and local), incorporating both medium- and long-term strategies and strengthening policies and frameworks in the spirit of partnership and cooperation.

The IPCC AR6 stated that adaptation gaps still exist and some ecosystems and regions have reached soft and hard limits⁴. **Further, increasing evidence of maladaptation across regions and sectors impels multi-sectoral, multi-actor, and inclusive planning for long-term climate change to minimize maladaptation.**

With these considerations, the NAP process, therefore, should be country-driven, gender-responsive, participatory, fully transparent, and inclusive of all stakeholders, including civil society, the private

¹IPCC (2023). Summary for Policymakers. In: *Climate Change 2023: Synthesis Report*. A Report of the Intergovernmental Panel on Climate Change. Can be accessed through this [link](#).

² Held on 29 to 10 December 2010 in Cancun, Mexico

³ Article 7 of the Paris Agreement to the UNFCCC (2015). Full text can be accessed through this [link](#).

⁴ Soft limits to adaptation are those solutions that may not be currently available but could be made available in the future through enabling conditions such as finance and technology while hard limits to adaptation are those already unattainable.



sector, academia and science, indigenous peoples, communities, ecosystems, and other vulnerable groups.

Through the NAP, countries are able to guide the public sector and partner stakeholders on the needed speed and scale in the provision and delivery of the means of implementation (MOI) and support in the form of climate finance, technology transfer and development, and capacity building, to be provided by developed country Parties under the UNFCCC and the Paris Agreement.

For the Philippines, the NAP process is spearheaded by the Climate Change Commission (CCC). Pursuant to Republic Act No. 9729 or the Climate Change Act, as amended, the CCC is the lead policy-making body of the government tasked to coordinate, monitor, and evaluate government programs on climate change, and ensure mainstreaming of climate change in national, local, and sectoral development plans, in coordination with relevant government agencies, partners, and stakeholders.

The Climate Change Act established the National Framework Strategy for Climate Change (NFSCC), a policy framework that emphasizes the Philippines' approach to climate change where adaptation serves as an anchor strategy, and mitigation is pursued as a function of adaptation. Within the NFSCC, the National Climate Change Action Plan (NCCAP) was developed to outline the long-term program and strategies for climate change adaptation with the national development plan. Founded on the NCCAP, the NAP process pursues the National Climate Risk Management Framework (NCRMF) in acknowledging the importance of risk profiling, assessment, and management needed to increase the adaptive capacity of communities through technology development and transfer and capacity building, projecting future and multiple scenarios on impacts.

1.1.2 Vision

“We will look to our partners and friends to help the Philippines, who, despite having a very small carbon footprint, is at the highest risk. First, spare victims; then help them recover; and move on to lessen the harmful impact of climate change. We too have our part to play.”

President Ferdinand Romualdez Marcos, Jr.

Inaugural Address, 30 June 2022

The foregoing words of President Ferdinand Romualdez Marcos, Jr. invokes the climate justice underpinnings of adaptation action in parallel with whole-of-nation efforts to transform society and the economy towards climate-resilient and sustainable development.

The Philippine NAP sets in place the adaptation priorities of the country at the national level towards enhanced adaptive capacities and increased resilience of communities and ecosystems to natural hazards and climate change, steadily reducing climate-related loss and damage, and optimizing mitigation opportunities.



1.1.3 Objectives

The overall goal of the Philippines' NAP is to **reduce the country's vulnerability to climate change impacts** through **building adaptive capacity and resilience** and **integrating adaptation into relevant policies and programs**. It aims to define an adaptation pathway that integrates sectoral and national development priorities and provides the framework to plan public spending, access multilateral funding, and raise private capital for adaptation.

Specifically, the NAP aims to:

- Harmonize national strategies with international commitments** to develop robust medium-, and long-term adaptation plans for building the country's adaptive capacity and resilience
- Provide guidance on integrating adaptation considerations** into planning, coordination, and implementation at all levels of government and across society and ecosystems, and
- Identify priority high-risk climate change vulnerable areas in the Philippines**, based on data and evidence, to serve as the basis for detailed risk assessments and adaptation programs

1.1.4 Logical Framework

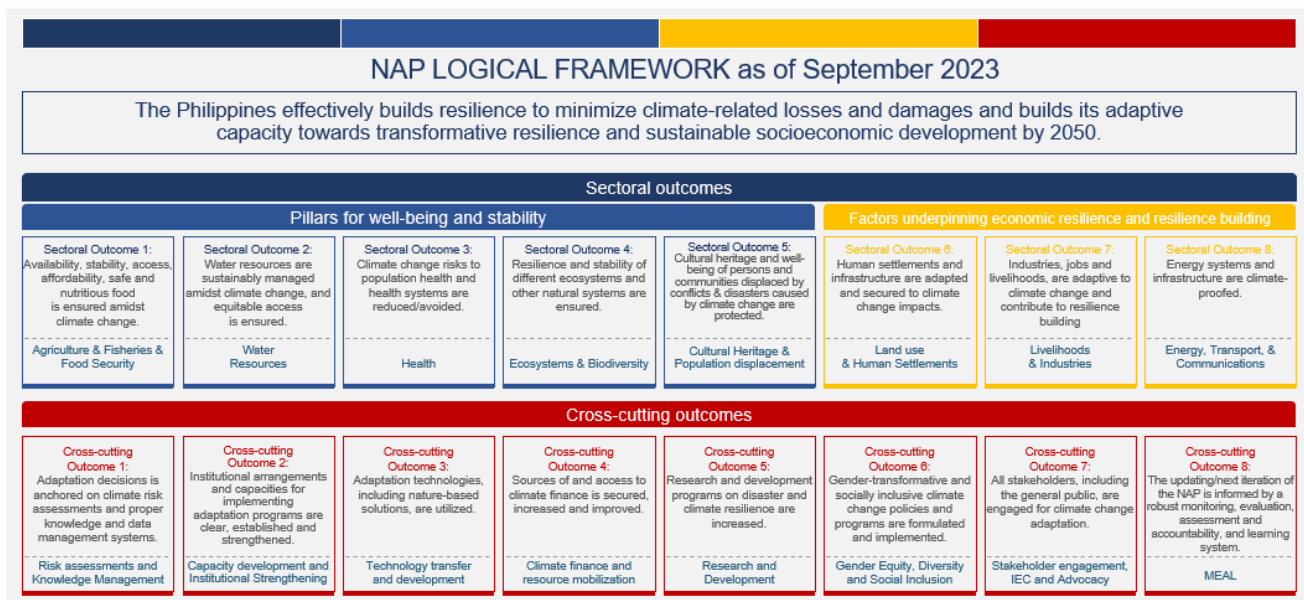


Figure 1.1.4.1 NAP Logical Framework

The NAP Logical Framework builds on the principles, priorities, concepts, structure, strategies, and approaches under the National Framework Strategy on Climate Change (NFSCC) 2010-22 and the National Climate Change Action Plan (NCCAP) 2011-2028).



Notably, the adaptation⁵ and mitigation⁶ pillars under the NFSCC and the seven thematic priorities of the NCCAP⁷ are the bases for the identification of the **Sectoral Outcomes 1-8** of the NAP given the importance of goods and services in the attainment of the overall objective of “steadily reducing climate-related loss and damage and to build the country’s adaptive capacity towards transformative resilience and sustainable economic development by 2050.”

The aspirational period of 2050⁸ is consistent with the Philippine climate change scenario considered under the NFSCC. As such, the logical framework endeavors to incorporate the UNFCCC-recommended convergence⁹ in adaptation planning among the post-2050 frameworks such as the Paris Agreement, Sendai Framework on Disaster Risk Reduction, and Sustainable Development Goals in ensuring that the NAP serves as a reference instrument to chart the long-term development agenda of the country, is beyond reactive but proactive, progressive, and anticipatory, and promotes locally led efforts but mindful of the impacts of regional and global dynamics.

With the intended application of scientific guidance and the use of appropriate methodologies, the NAP intends to lay down challenges and opportunities for innovative and transformative actions on sectoral outcomes through the support mechanism under **Cross-Cutting Outcomes 1-8**.

This embodies the ***science-policy-action continuum*** that best epitomizes the needed synergy rather than a trade-off between adaptation and mitigation actions.

The value chain for vital goods and services that support human systems (e.g., food, water, health, community, and ecosystems nexus) is at risk amidst uncertainties and severity of adverse climate change impacts and limits of adaptation. Human Security is thus considered an overarching consideration of climate change actions, and thus its core elements under the NCCAP are now separate sectoral outcomes, e.g., health as a primary sector, also following the path to post-pandemic recovery; the jobs and livelihoods sector, in view of just transition concerns; the land use and human settlements sector; and discussions on mobility and displacement, with their nexus on conflict and DRRM.

⁵Adaptation Pillars, NFSCC: Enhanced Vulnerability and Adaptation Assessments, Integrated Ecosystems-based Management, Climate-Responsive Agriculture, Water Governance and Management, and Disaster Risk Reduction Management

⁶Mitigation Pillars, NFSCC: Energy Efficiency and Conservation, Renewable Energy, Environmentally Sustainable Transport, Sustainable Infrastructure, National REDD+ Strategy, and Waste Management

⁷Thematic Priorities of the NCCAP: Food Security, Water Sufficiency, Ecological and Environmental Stability, Human Security, Climate-Friendly Industries and Services, Sustainable Energy, and Knowledge and Capacity Development

⁸NFSCC, p. 9, citing a document prepared by PAGASA for the Philippines’ Second National Communication on Climate Change

⁹UNFCCC. Opportunities and options for integrating climate change adaptation with the Sustainable Development Goals and the Sendai Framework for Disaster Risk Reduction 2015–2030. Technical paper by the secretariat. / UNFCCC/TP/2017/3.



This also requires that knowledge base and capacity building on the foregoing are implanted by experts and academia—on the ground—ensuring that intergenerational equity also means preparing and honing future climate experts, leaders and actors.

The methods of probabilistic risk assessment, as complemented by interoperable and user-friendly data analytics and tools such as the GeoRiskPH platform of the Department of Science and Technology, will help ensure that various segments of the population—from policymakers to citizens, industry stakeholders, and development partners—are part of a solutions-oriented NAP process.

Towards a “societal transformation-focused NAP”, due consideration must be made of the National Innovation Agenda and National Security Policy in the context of social and climate justice, inclusivity, and the efforts to achieve lasting peace across the country to ensure that ***no one is left behind up to the smallest unit of governance of the Philippines.***



1.2 NAP Guiding Principles

The Philippines' NAP is envisioned as:

- Compliant with the UNFCCC guidelines on NAP development.
- Aligned with existing national policies, programs, and international agreements such as the UNFCCC and the Paris Agreement, the UN Sustainable Development Goals, Sendai Framework for Disaster Risk Reduction, and Kunming-Montreal Biodiversity Framework, among others.
- Formulated based on the best available science and technologies, with strategies drawn from scientific contributions and community-based best practices, and as appropriate, traditional knowledge, indigenous people's knowledge, and local knowledge systems while considering diverse local climate adaptation needs.
- Based on evidence and informed by risks, with fit-for-purpose adaptation actions formulated based on the causes, magnitude, and impacts of identified risks.¹⁰ Long-term strategies to also consider the intersecting vulnerabilities and complexities of addressing such risks.
- Promotes a rights-based approach to climate change adaptation and accessing climate justice, building upon the principle of Leaving No One Behind (LNOB), thus participatory, inclusive and reaching up to the last mile with the most vulnerable at the forefront of planning.
- Guided by the Precautionary Principle¹¹ acknowledging the rapidly narrowing window of opportunity for effective climate action and the hard and soft limits to adaptation (IPCC AR6). Anticipatory measures are undertaken to minimize climate-related losses and damages and not account for the lack of full scientific uncertainty to delay implementation of adaptation actions.
- Based on the principle of common but differentiated responsibilities, respective capabilities, and equity,¹² putting a premium on ensuring the equal and equitable protection of women and girls, children, youth, persons with disabilities indigenous peoples, and senior citizens, further acknowledging the need to enhance their adaptive capacities.
- Aligned with long-term strategies with a “well-being lens” wherein adaptation actions contribute to increased income and job opportunities, improved public health, and enhanced knowledge and skills, and local empowerment, among others.¹³

¹⁰ National Climate Change Action Plan (NCCAP 2011-2028). Retrieved from this [link](#).

¹¹ “Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures, taking into account that policies and measures to deal with climate change should be cost-effective so as to ensure global benefits at the lowest possible cost.” Source: United Nations Framework Convention on Climate Change (UNFCCC). (1992). Retrieved from: <https://unfccc.int/resource/docs/convkp/conveng.pdf> / UNFCCC Handbook. (2006). Retrieved from: <https://unfccc.int/resource/docs/publications/handbook.pdf>.

¹² RA 9729, as amended;

¹³ PDP 2023-2028. Chapter 15. Retrieved from this [link](#).



- Cognizant of the value of a multi-stakeholder inclusivity and participatory approach in ensuring effective and sustainable adaptation strategies while avoiding maladaptation, including partnerships with civil society, the private sector, the international community, local governments, the academe, indigenous peoples, different subgroups of persons with disabilities such as the deaf, blind, etc., and other marginalized groups most vulnerable to climate change.
- Guided by the principles for locally-led adaptation¹⁴ which recognized local communities as front liners of climate change impacts and the need to develop flexible and inclusive programs, accessible funding, and transparent and collaborative practices towards adaptation that is increasingly owned and sustained by local stakeholders.
- Embodies an intergenerational and inclusive commitment, aiming to safeguard present and future generations against the gradual but persistent impacts of climate change.
- Cognizant of incremental adaptation¹⁵ as moving towards disaster resilience while transformational adaptation¹⁶ as moving towards climate resilience.

¹⁴ Principles of Locally Led Adaptation (2022). Global Commission on Adaptation. <https://www.wri.org/initiatives/locally-led-adaptation/principles-locally-led-adaptation>

¹⁵ Incremental adaptation are interventions that preserve the essence and integrity of the prevailing technological, institutional, governance, and value systems e.g. introduction of new cropping systems, altering planting times, and establishing efficient irrigation systems.

¹⁶ Transformational adaptation refers to the body of interventions that, to the extent of greater magnitude than incremental interventions, alter the systems' basic characteristics in response to actual or expected climate and its effects.



1.3 NAP Processes and approach

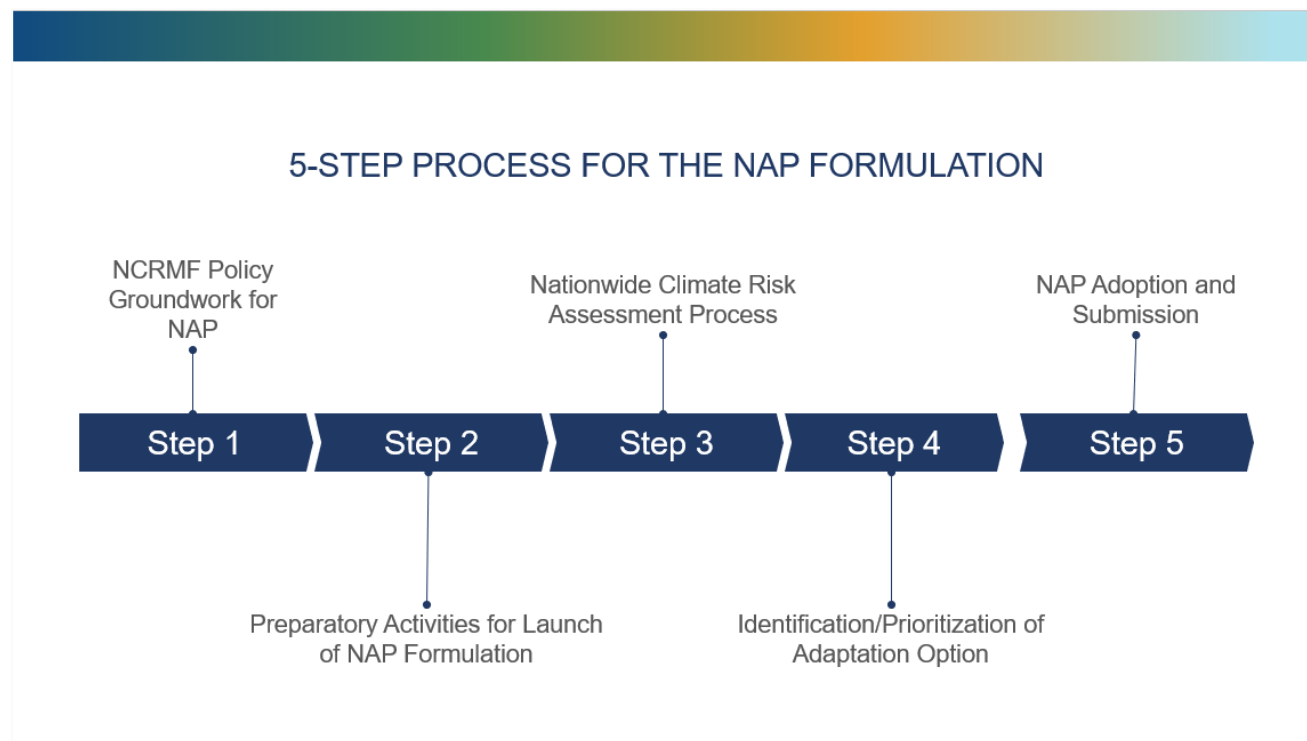


Figure 1.3.1 The 5-step Process for the NAP Formulation in the Philippines

As a national policy, **Climate Change Commission Resolution No. 2019-001¹⁷ on the National Climate Risk Management Framework (NCRMF)** provides evidence-based guidance to the public sector to undertake risk profiling, assessment, and management needed to increase the adaptive capacity of communities through technology development and transfer and capacity building, utilizing probabilistic risk assessment methods to consider future scenarios on impacts.

The NCRMF aims to address the challenging aspect of NAP formulation by establishing a clear and organized framework of action to enable systematic characterization, including quantification of risks and impacts, to identify and organize adaptation measures addressing all actual and potential impacts of climate change. Consultations were conducted and a **national stock take survey** on available climate risk datasets, information, tools, methodologies, capacities, and mechanisms was completed, involving national government agencies, academic institutions, and local government units from Luzon, Visayas, and Mindanao. Although the stock take survey did not encompass all the National Government Agencies (NGAs), Local Government Units (LGUs), Academe, Civil Society Organizations (CSOs)/ Non-Government Organizations (NGOs), and other stakeholders, the survey results provide an overview of data generation (i.e., slow and sudden onset) across different levels of governance and sectors in the country.

The second step comprises the **Preparatory Activities for the Launch of the NAP formulation**. This involves **technical discussions and scoping activities** to identify climate risks and

¹⁷ CCC Commission Resolution No. 2019-001. Retrieved from this [link](#).



vulnerabilities in the Philippines. Furthermore, sectoral plans and adaptation measures will be revisited through the NCCAP Monitoring & Evaluation (M&E).

The third step is undertaking the **Nationwide Climate Risk Assessment Process** which gathers and analyses available data and information through developing **country-specific climate risk models**. **Parameters, methodology, and limitations for risk assessment** are identified, and syndicated with agencies concerned through the continuous consultations.

Guided by the risk models generated, the fourth step relates to the **identification and prioritization of adaptation options**. Adaptation options are determined according to the identified high-risk areas in the climate risk assessment. Implementation strategies and their costing estimates are identified on the basis of the prioritization analysis (i.e., Cost-Benefit or Multi-Criteria Analysis). These are validated through the conduct of nationwide multi-sectoral consultations

The Philippines' NAP is then presented to the Climate Change Commission Advisory Board (CCCAB) for **adoption by the President of the Republic, and subsequent submission to the UNFCCC**.

Upon adoption, a **strategic NAP rollout communications plan** will be released for wide dissemination, including to development partners to direct funding support where they are most needed.

Cognizant of strengthening the scientific and policy grounding for the NAP process, the **Consultative Group of Experts (CGE)** has been established to provide high-level scientific and technical advisory support to the Philippine government in the NAP development.

Specifically, the CGE is expected to:

- a. Provide guidance on reports, tools, approaches, and other considerations for incorporating the best available science and technologies in the NAP development;
- b. Review the NAP drafts; and
- c. Ensure NAP final output alignment to international scientific standards/ peer review

Furthermore, a multi-stakeholder coordination mechanism through a dedicated **NAP - National Steering Committee (NAP-NSC)** was created to provide recommendations, overall guidance, and strategic direction for the Philippines' NAP, including but not limited to the following:

1. **Risk assessment** (i.e., baseline and evidence basis for adaptation planning; climate risks and impact drivers; tools, methodologies and approaches to use);
2. **Planning and development** (i.e., logical framework or set of indicators, outcomes, and targets; identification and/or prioritization of sectors and adaptation solution; resource mobilization);
3. **Implementation** (i.e., stakeholder engagement, communication, and capacity-building strategies), and
4. **Monitoring, evaluation, and learning** (i.e., reporting and updating; results-based M&E systems and information/knowledge management).



The NAP-NSC undertakes to harmonize and integrate the execution of its tasks, roles, and responsibilities in the formulation and implementation of the NAP.



National Circumstances

Chapter

02



2. National Circumstances

2.1 Geography

The Philippines is an archipelago composed of 7,641 islands within three (3) major island groups: Luzon, Visayas, and Mindanao. It has a total land area of 298,170 square kilometers and a coastline of 36,289 kilometers.¹⁸

Surrounded by bodies of water, the Philippines has its Pacific Ocean on the east, the West Philippine Sea on the west, Basha Channel on the north, and the Sulu and Celebes Sea on the south.

In terms of topography, Luzon, and Mindanao are characterized by alluvial plains, narrow valleys, rolling hills, and high mountains. Most of the smaller islands, such as those in the Visayas, have a mountainous interior surrounded by narrow strips of discontinuous flat lowlands on the coastal rims. The shorelines of both large and small islands are irregular.

Given the environment and geography, the Philippines is among the mega-biodiverse countries in the world, being home to a vast array of between 70% and 80% of the world's plant and animal species.¹⁹



Figure 2.1.1 Location map

The fertile land accounts for its rich biodiversity. For fauna, an estimated 49% of terrestrial wildlife species are considered endemic, with highly endangered species like the Philippine eagle, tarsier, and mouse deer.

Being in the Tropical Cyclone belt and the Pacific Ring of Fire, the country is extremely vulnerable to climate-related and geological hazards that include around 20 tropical cyclones every year and an almost daily occurrence of seismic shocks, which cost the country losses and damage at an average of 0.5% of GDP annually.²⁰

Metro Manila, the country's largest metropolis comprising 16 cities (including the capital, Manila City) and one municipality, is strategically located in the middle of Luzon. It is bounded by Manila Bay on the west and Laguna de Bay on the southeast. The Pasig River, a major waterway, runs through the

¹⁸ Water Environment Partnership in Asia (WEPA). Retrieved from https://www.google.com/url?q=https://wepa-db.net/wp-content/uploads/2023/02/1_State-of-water-environment_PHL.pdf&sa=D&source=docs&ust=1689162133539215&usq=AOvVaw1vF0y9SYsxQrf-0l3jmjSw

¹⁹ Convention on Biological Diversity. Philippine Country Profile. Retrieved from <https://www.cbd.int/countries/profile/?country=ph>

²⁰ The Philippines' Nationally Determined Contribution (NDC) as submitted in 2021, and 2011 Philippine Disaster Risk Reduction and Management Plan (PDRMP)



metropolis. The 633 square kilometer metropolis sits in the middle of a floodplain that is one of the biggest in the country. Metro Manila has a population of 13.48 million as of 2020.²¹

Other major metropolitan areas in the Philippines are Metro Cebu and Metro Davao as indicated under the Philippine Development Plan (PDP) 2017-2022.²²

²¹ 2020 CPH, PSA

²² PDP 2017-2022



2.2 Population

Based on the 2020 Census of Population and Housing (2020 CPH) as conducted by the Philippine Statistics Authority (PSA), the total population is 109,035,343. With an increase of 8,053,906 persons from the 2015 Census, the annual population growth rate is at 1.63%. By 2045, the Philippines is estimated to have a population of 142 million.²³

In terms of age and sex disaggregation of the household population, the Philippine population consists of 50.6% males and 49.4% females. This translates to a sex ratio of 103 males per 100 females.

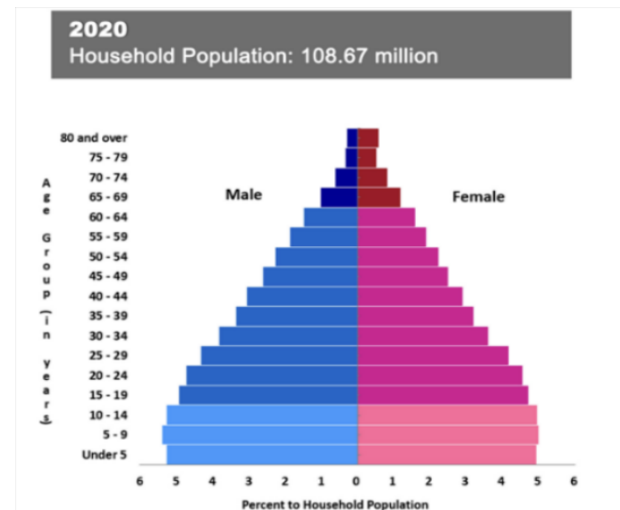


Figure 2.2.1 Population Pyramid of 2020 CPH

As regards age distribution, there are 33.4 million (30.7%) Filipinos under 15 years old, which is considered as young dependents and 5.86 million (5.4%) are over 65 years old which is considered as old dependents. These age groups are considered the most vulnerable to climate change. On the other hand, almost 60.40 million (64%) of Filipinos are between 15 to 65 years old, representing those at working age or in the economically active population. The overall dependency ratio of the Philippines declined in 2020 at 57 dependents per 100 working-age population from 58 dependents per 100 working-age population in 2015. The Philippines is predominantly a Catholic country, with 85,645,362 (78.8%) of the total household population²⁴ being Roman Catholics followed by Islam with 6,981,710 persons (6.4%), and Iglesia ni Cristo with 2,806,524 persons (2.6%). The highest proportion of the household population who are Roman Catholic is found in Bicol Region, while the region with the lowest number is in the BARMM region, which is home to the largest portion of the Islam household population of 4,491,168 persons.²⁵

The country's functional literacy rate is at 91.6% based on the 2019 Functional Literacy, Education and Mass Media Survey (FLEMMS)²⁶, a rate generally higher than the results of the 2013 survey. A high functional literacy rate translates to a population equipped with more advanced skills than reading and writing and a better ability to function fully and efficiently.

²³ Based on projected population from 2010 Census of Population and Housing, PSA

²⁴ In 2020, the total household population comprised of 108,667,043 persons (99.7%) of the total population with the remaining 368,300 (0.3%) are those residing in institutional living quarter such hospitals, orphanage, military camps, and filipinos residing in embassy, consulates and mission abroad. (PSA, 2022)

²⁵ PSA (2023). Religious Affiliation in the Philippines (2020 Census of Population and Housing). <https://psa.gov.ph/content/religious-affiliation-philippines-2020-census-population-and-housing>

²⁶ Functional Literacy, Education, and Mass Media Survey (FLEMMS) by PSA, 2019



As to population distribution, Region IV-A CALABARZON is the most populous, with 15% of the population residing in the region, followed by the National Capital Region (12%), and Region III Central Luzon (11%). Least populous are Cordillera Administrative Region (2%), Region XIII CARAGA (2.5%), and Region IV-B MIMAROPA (3%).

Reflecting on the portion of the population residing in coastal areas, the Philippine Ocean Economy Satellite Accounts (POESA) reported that 832 out of the 1,500 municipalities (55.47%) and 57 of the 117 cities (48.72%) are situated along the coast, and 64 of the 72 provinces (81.01%)²⁷ have coastal domains.

In terms of the level of urbanization, 54% of the population is residing in urban barangays. This represents an increase of 2.8% or 7.2 million persons moving from rural to urban from 2015 CPH.

Based on the 2018 National Migration Survey conducted by the Philippine Statistics Authority (PSA) and the University of the Philippines, the top regional destinations of lifetime migrants, or those permanently leaving their usual residence of the mother at the time of birth, are NCR, Region IV-A CALABARZON, Central Luzon, Davao, and Central Visayas. While there is no national data available on population displacement due to extreme weather events, the IPCC has reported that Asia has the largest number of displaced populations caused by these events.

Population growth, characteristics, and distribution are significant considerations in policy development, planning, and implementation. These factors must be included in the assessment of needs and gaps in ecosystem services and the overall needs of the population, in line with other national economic and sustainable development aspirations.

Population growth and migration trends need to be carefully studied, particularly in view of movements towards high-risk and disaster-prone areas. These factors highlight the need for proactive measures and strategies to address the challenges posed by population dynamics and their intersection with climate change impacts.

The breakdown of age groups and dependency ratio shows the portion of the population that are vulnerable to climate hazards and those who could potentially pose an additional burden in terms of dependency. Any implementation of adaptation measures should therefore take into account the context of these groups. Furthermore, in view of the presented sex ratio, it is crucial for adaptation measures to be gender-responsive and to ensure inclusive and equal representation in the decision-making process.

²⁷ Philippine Ocean Economy Satellite Accounts (POESA)



2.3 Economy

The Philippines has shown overall significant progress in economic development despite challenges caused by geopolitical conflicts, the COVID-19 pandemic, and domestic issues in the previous years. Before the pandemic, the Philippines GDP had an average growth rate of 5%.²⁸ Progress was seen in terms of the growth in gross domestic product (GDP) at 7.6 percent in 2022 (even above the target of 7.5%), and the decline in the unemployment and underemployment rates in the same period.²⁹

The country's economy is significantly attributed to three (3) key industry sectors: (i) agriculture, hunting, forestry, and fishing; (ii) industry; and (iii) services.

In the first quarter of 2023, services accounted for 61.1% of the total Gross Domestic Product (GDP), while the industry sector and the agriculture, hunting, forestry, and fishing sector contributed 29.9% and 9.1%, respectively.³⁰

The country has garnered positive assessments from credit rating agencies. As of 2022, S&P Global gave the Philippines a credit rating of BBB+, while Fitch and Moody's Investor Service assigned BBB and Baa2 ratings, respectively.³¹ While these ratings fall just below the investment grade, these reflect the Philippines' robust economic outlook supported by strong domestic spending from both the public and private sectors, rapid economic growth, a flourishing service sector, reduced inflation, currency appreciation, increased foreign exchange reserves, and a lower proportion of government debt to GDP.

In terms of economic performance, the Philippines achieved an impressive 6.4% GDP growth in the first quarter of 2023, placing it among the fastest-growing economies globally.³² Furthermore, in the fourth quarter of 2022, the Philippines recorded a 7.2% growth in GDP, demonstrating its resilience as one of the better-performing economies in the region.³³

²⁸ Extracted from PSA Openstat: <https://openstat.psa.gov.ph/>

²⁹ NEDA Annual Report 2022: Stewarding the Transition from Recovery to Socioeconomic Transformation

³⁰ Extracted from PSA: <https://psa.gov.ph/national-accounts/sector/Services>; <https://psa.gov.ph/national-accounts/sector/Industry>; <https://psa.gov.ph/national-accounts/sector/Agriculture,%20Forestry%20and%20Fishing>

³¹ Extracted from agency websites: <https://www.dof.gov.ph/sp-global-reaffirms-ph-rating-at-bbb-maintains-stable-outlook-in-view-of-strong-domestic-demand/#:~:text=Credit%20watcher%20S%26P%20Global%20has,to%207.5%20percent%20for%202022.>

<https://www.fitchratings.com/research/sovereigns/fitch-affirms-philippines-at-bbb-outlook-negative-27-10-2022>

https://www.moody.com/credit-ratings/Philippines-Government-of-credit-rating-607410/reports?category=Ratings_and_Assessments_Reports_rc%7Cissuer_Reports_rc&type=Rating_Action_rc%7CAnnouncement_rc%7CAnnouncement_of_Periodic_Review_rc,Credit_Opinion_ir_rc%7Cissuer_in_Dept_rc

³² Extracted from PSA: <https://psa.gov.ph/content/gdp-expands-64-percent-first-quarter-2023#:~:text=The%20Philippine%20Gross%20Domestic%20Product,the%20second%20quarter%20of%202021.>

³³ Extracted from PSA: <https://psa.gov.ph/content/gdp-expands-72-percent-fourth-quarter-2022-and-76-percent-full-year-2022>



Currency dynamics have also played a role in shaping the economic landscape. In 2022, the Philippine peso depreciated from PHP51.23 per US dollar in January to a rate of PHP58.82 in October.³⁴ Meanwhile, the gross international reserves of the Philippines reached USD102 billion as of the end of March 2023, rising from USD98.2 billion in February of the same year. The government debt-to-GDP ratio reached 60.3% at the end of 2022, compared to 39.6% in 2019. This percentage aligns with those of other countries like Thailand, while Malaysia and Singapore exhibit even higher ratios.³⁵ The Philippine Stock Exchange, Inc. (PSE), anticipates a rebound in local shares for 2023, banking on the further reopening of the economy following a 7.8% drop in the main index in 2022.

Despite these positive economic indicators, the Philippines remains highly vulnerable to natural hazards, particularly those linked to climate and weather.³⁶ Aside from the direct impacts of altered climate patterns, contributing to this vulnerability is the populace's limited capacity to protect, adapt, and manage their surroundings due to poverty, lack of knowledge, and inadequate resources. Moreover, the country's significant dependence on coastal areas and the exploitation of natural resources from the sea, land, and forests by numerous Filipino families further amplifies its susceptibility to the adverse effects of climate change.³⁷

Guided by the Ambisyon Natin 2040 or the long-term vision of the Philippine government for socioeconomic development, the administration of President Ferdinand Romualdez Marcos, Jr. adopted the Philippine Development Plan (PDP) 2023-2028³⁸ with specific actions to achieve the 8-point socioeconomic agenda of the national government:

1. Protect purchasing power and mitigate socioeconomic scarring by ensuring food security, reducing transportation and logistics costs, and lowering energy expenses for households;
2. Reduce vulnerability and long-term adverse effects of the COVID-19 pandemic by addressing health concerns, strengthening social protections, and tackling learning losses; and
3. Ensure sound macroeconomic fundamentals by enhancing bureaucratic efficiency, implementing robust fiscal management practices, and fostering a resilient and innovative financial sector.
4. Create more job opportunities by promoting trade and investments, improving infrastructure, and attaining energy security;
5. Create high-quality jobs by enhancing employability, promoting research and development, fostering innovation, and strengthening the digital economy;

³⁴ Bangko Sentral ng Pilipinas. Retrieved from: <https://www.bsp.gov.ph/statistics/external/Table%2012.pdf>

³⁵ Philippine News Agency. Retrieved from: [PH debt-to-GDP ratio still not at alarming level | Philippine News Agency \(pna.gov.ph\)](https://pna.gov.ph/PH-debt-to-GDP-ratio-still-not-at-alarming-level-Philippine-News-Agency)

³⁶ The Philippines ranks first most vulnerable to climate and disasters based on Germanwatch's World Risk Index 2022

³⁷ Extracted from: [PH doubly vulnerable to climate change: ADB \(malaya.com.ph\)](https://malaya.com.ph/PH-doubly-vulnerable-to-climate-change-ADB)

³⁸ Retrieved from <https://pdp.neda.gov.ph/wp-content/uploads/2023/01/PDP-2023-2028.pdf>



6. Create green jobs by pursuing a green economy and establishing livable and sustainable communities;
7. Uphold public order, safety, peace, and security; and
8. Ensure a fair and competitive environment by strengthening market competition and reducing barriers to entry and entrepreneurship.

Baseline information stated in the PDP include the total accounted loss and damage of PHP 673.3 billion from tropical cyclones for the period of 2011 to 2021.³⁹ Under the business-as-usual (BAU) scenario, loss and damage from climate change is anticipated to increase and could account for up to 7.6% of the nation's GDP by 2030 and 13% by 2040.⁴⁰

As sustainable development is an integral part of the long-term climate change adaptation planning, impact to poverty eradication is a crucial indicator of NAP effectiveness, a motivator to ensure that inclusive transformation of the economy and society is achieved.

Figure 2.3.1 presents information on poverty incidence in the Philippines based on the preliminary results of the 2021 Family Income and Expenditure Survey (FIES).⁴¹

The preliminary results showed that 19.99 million Filipinos (18.1%) are living below the poverty threshold, and 3.50 million families (13.2%) were considered poor.⁴²

Highest poverty incidence was recorded in the Administrative Region in Muslim Mindanao (ARMM), and lowest in the National Capital Region, Cordillera Administrative Region, Region III Central Luzon, and Region IV-A CALABARZON.

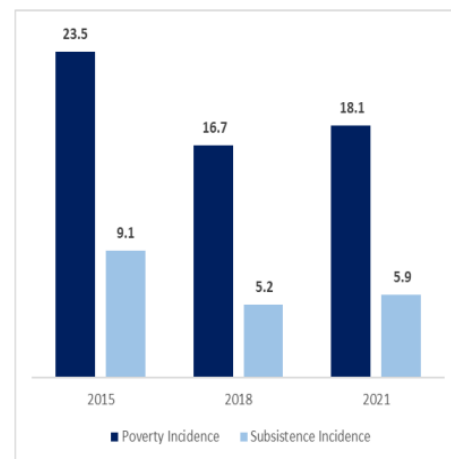


Figure 2.3.1 Poverty and Subsistence Incidence Among Population⁴³

³⁹ Philippine Development Plan 2023-2028.

⁴⁰ Philippines Country Climate and Development Report 2022, World Bank Group.

⁴¹ Proportion of Filipinos whose per capita income cannot sufficiently meet the individual basic food and non-food needs.

⁴² Preliminary 2021 Full Year Official Poverty Statistics of the Philippines, PSA.

⁴³ Philippine Statistics Authority (2022). Proportion of Poor Filipinos was Recorded at 18.1 Percent in 2021. <https://psa.gov.ph/poverty-press-releases/nid/167972>



These realities underscore the imperative for the Philippines to enhance its resilience and preparedness in the face of climate-related challenges, ensuring sustainable development and safeguarding the well-being of its population.

Under PDP 2023-2028, it is a priority of the government to accelerate poverty eradication and bring the poverty incidence into a single digit, building on strategies that were sustained in the past years including increasing human capital investments and further expansion of the conditional cash transfers or the 'Pantawid Pamilyang Pilipino Program'.

Part of achieving deep economic and societal transformation is the attainment of the Philippines' vision of becoming an upper middle-income country by 2025, and further sustained high levels of growth until 2040.



2.4 Governance

The Philippines is a democratic republic with a presidential system of government. The powers of the government are equally divided among three (3) sovereign but interdependent branches: Executive, Legislative, and Judicial. This government system ensures checks and balances while adhering to the doctrine of separation of powers.

- Executive branch. Composed of the President, the Vice President, and Cabinet members. The executive branch of government exercises supervision over local government units.
- Legislative branch. Enacts national laws and statutes including the annual national budget.
- Judicial branch. Composed of the Supreme Court, appellate and lower tribunals as established by law. The judiciary exercises the power of judicial review.

At the local level, the territorial and political subdivisions of the Philippines are provinces, cities, municipalities, barangays, special metropolitan subdivisions, and autonomous regions. In a move towards decentralization, the Congress enacted Republic Act No. 7160, or the Local Government Code in 1991. This code enabled local government units (LGUs) to enjoy local autonomy and to exercise certain basic powers that are decentralized and devolved by the national government. The President of the Philippines exercises general supervision over LGUs.

In terms of **local administrative jurisdictions**, the country is divided into 17 administrative regions, with a total of 82 provinces, 148 cities, 1,486 municipalities, and 42,047 barangays, the smallest political unit.⁴⁴

Under the 1987 Philippine Constitution, it is the policy of the State to “*afford full protection and the advancement of the right of the people to a balanced and healthful ecology... to fulfill human needs while maintaining the quality of the natural environment for current and future generations.*”

Anchored on the above, the Philippine government established the Climate Change Commission (CCC), with the President as its Chairperson, as the lead policy-making body of the government tasked to coordinate, monitor, and evaluate the programs and action plans relating to climate change. The CCC is created by virtue of Republic Act No. 9729 or the ‘Climate Change Act of 2009’, later amended by Republic Act No. 10174.

Specific functions of the CCC are as follows⁴⁵:

- (a) Coordinate and synchronize climate change programs in consultation with national government agencies and other stakeholders;
- (b) Formulate a Strategic Framework on Climate Change to serve as the basis for a program for climate change planning, research and development, extension, and monitoring of activities on climate change;

⁴⁴ Philippine Standard Geographic Code as of 31 March 2023, PSA

⁴⁵ Section 9 of the RA No. 9729 as amended



- (c) Exercise policy coordination to ensure the attainment of goals set in the strategic framework and program on climate change;
- (d) Recommend legislation, policies, strategies, programs on and appropriations for climate change adaptation and mitigation and other related activities;
- (e) Recommend key development investments in climate-sensitive sectors such as water resources, agriculture, forestry, coastal and marine resources, health, and infrastructure to ensure the achievement of national sustainable development goals;
- (f) Create an enabling environment for the design of relevant and appropriate risk-sharing and risk-transfer instruments;
- (g) Create an enabling environment that shall promote broader multi-stakeholder participation and integrate climate change mitigation and adaptation;
- (h) Formulate strategies for mitigating GHG emissions, anthropogenic sources and enhance removal by sinks;
- (i) Coordinate and establish a close partnership with the National Disaster Risk Reduction and Management Council in order to increase efficiency and effectiveness in reducing the people's vulnerability to climate-related disasters;
- (j) In coordination with the Department of Foreign Affairs, represent the Philippines in the climate change negotiations, constitute and lead the Philippine panel of negotiators to the UNFCCC and the formulation of official Philippine positions on climate change negotiation issues, and decision areas in the international negotiation arena;
- (k) Formulate and update guidelines for determining vulnerability to climate change impacts and adaptation assessments and facilitate the provision of technical assistance for their implementation and monitoring;
- (l) Coordinate with local government units (LGU's) and private entities to address vulnerability to climate change impacts of regions, provinces, cities and municipalities;
- (m) Facilitate capacity building for local adaptation planning, implementation and monitoring of climate change initiatives in vulnerable and marginalized communities and areas;
- (n) Promote and provide technical and financial support to local research and develop merit programs and projects in vulnerable and marginalized communities and areas;
- (o) Oversee the dissemination of information on climate change, local vulnerabilities and risks, relevant laws and protocols and adaptation and mitigation measures;
- (p) Establish a coordination mechanism with the concerned government agencies and other stakeholders to ensure transparency and coherence in the administration of climate funds taking into consideration the official Philippine position in international negotiations; and



(q) Perform such other functions as may be necessary for the effective implementation of this Act.”

Since its establishment, the CCC developed policy frameworks and national planning documents that guide the formulation and implementation of climate change programs by relevant NGAs, LGUs, institutions, and stakeholders:

- **National Framework Strategy on Climate Change (NFSCC).** Formulated in 2010, sets the country’s agenda for climate change adaptation as an anchor strategy while capitalizing on mitigation opportunities. The Framework served as a basis for the national program on climate change. It identified Key Result Areas to be pursued in key climate-sensitive sectors in addressing the adverse effects of climate change both under adaptation and mitigation.
- **National Climate Change Action Plan (NCCAP).** Formulated in 2012, the NCCAP serves as the operational plan of the NFSCC. It outlines the country’s long-term agenda for adaptation and mitigation for 2011-2028. It outlines key strategies to enhance the adaptive capacity and resilience of vulnerable communities and ecosystems to climate change. The NCCAP focuses on seven (7) thematic priorities, namely: Food Security, Water Sufficiency, Ecological and Environmental Stability, Human Security, Climate Smart Industries and Services, Sustainable Energy, and Knowledge and Capacity Development.
 - A NCCAP Result Based Monitoring and Evaluation (RBMES) was implemented to comprehensively monitor and evaluate the NCCAP Implementation. The RBMES was built on government initiatives to integrate climate and disaster risk into the planning process. Using the RBMES, the Philippines conducted the NCCAP M&E report for FY 2011-2016. The report examined the government’s actions in mainstreaming climate change through enabling policies, plans, programs, institutional capacities, and knowledge management systems. The M&E findings made clear the necessity to improve the institutional capacity of the government and enhance convergence amongst government institutions in order to implement and monitor climate programs on the ground.
- **National Climate Risk Management Framework (NCRMF).** Adopted in 2019 through a Commission Resolution, underpins the Philippines’ climate change adaptation and loss and damage management work seeking to advance the risk assessment methodology in view of the increasing uncertainty surrounding climate change.
- **Nationally Determined Contribution (NDC).** Submitted to the UNFCCC in April 2021, sets the country’s 75 percent⁴⁶ greenhouse gas emission reduction and avoidance target for the Agriculture, Waste, Industry, Processing, and Product Use, Transport, and Energy sectors for 2020-2030.

Furthermore, the CCC developed the **Philippine Country Programme for the Green Climate Fund for the period, 2019–2023** taking into account the need for the Philippines to access the GCF for the

⁴⁶ Attaining 72.29% of the target is conditional and contingent upon availability of access to support from developed countries while the remaining 2.71% is unconditional and implemented mainly using domestic resources.



implementation of the adaptation and mitigation programs and projects for the achievement of climate resilience and green growth. The PCP was developed consistent with the GCF's strategic result areas and investment criteria, particularly country ownership and sustainable development potential, and aimed at ensuring gender-responsiveness and compliance with environmental and social safeguards. There were nine (9) thematic areas classified for the programs and project concepts in the PCP namely:

1. Enabling the overall environment for green finance and climate investments
2. Development and promotion of climate-resilient frameworks, practices, and business systems in the agriculture and fisheries sectors
3. Promotion of sustainable energy and transport
4. Integration of resource- and energy-efficient designs and systems in domestic, commercial, and industrial use
5. Promotion of green, sustainable, and livable cities
6. Development of climate-resilient ecosystems
7. Promotion of climate-responsive social protection programs
8. Provision of climate information services
9. Integration and active involvement of indigenous peoples in Climate Change Adaptation and Mitigation- Disaster Risk Reduction (CCAM-DRR) initiatives

Figure 2.4.1 shows the timeline of climate change-related laws and policies enacted since 1987. Prior to enacting the Climate Change Act, several climate-related policies and laws were already in place that aimed to address the impacts of climate change, promote environmental protection, and preserve and conserve natural resources.

- **Administrative Order No. 220 s. 1991** established an Inter-Agency Committee on Climate Change tasked to formulate climate change policies and response strategies, identify information needs for UN negotiations, establish working groups to monitor and assess local climate change, environment, and socio-economic impacts, and appoint a focal point to engage with international organizations.
- **Administrative Order No. 171 s. 2007** created the Philippine Task Force on Climate Change (PTFCC) to assess and address the impacts of climate change, implement measures to prevent and reduce greenhouse gas emissions and compliance with air emission standards, conduct public awareness and coordination with international partners, and mainstream climate change in government policies, programs, and plans.
- **Executive Order No. 774 s. 2008** reorganized the PTFCC and established task groups to implement adaptation and mitigation measures in environmental protection, water management, agriculture, and fisheries, transport and energy sector, information and education, international relations, and economic development.
- **Proclamation No. 1667 s. 2008** declared the celebration of the "Global Warming and Climate Change Consciousness Week" every November 19-25 of every year.
- **Executive Order No. 785 s. 2009** mandates the PTFCC to develop a National Climate Change Framework and coordinate, monitor, and review the country's climate change adaptation and mitigation programs. The EO also instructs for the development of a national Information, Education, and Communication Program on climate change.



- **Republic Act No. 8435** – Agriculture and Fisheries Modernization Act aims to modernize the agriculture and fisheries sector by advancing new technology, promoting equitable access to resources, pursuing a market-driven approach, increasing profitability, ensuring food security and promoting sustainability, and empowering small farmers and fisherfolks. The act required the regular monitoring and consideration of the effects of climate change, weather disturbances, and the annual productivity cycle in developing agriculture and fisheries production programs.
- **Republic Act No. 8749** – Clean Air Act of 1999 established the country's air quality management program to prevent emissions and to meet the prescribed air emission standards. The Act also required the development of national plans to reduce greenhouse gas emissions in the country.
- **Republic Act No. 9003** – Ecological Solid Waste Management Act of 2000 aims to establish a comprehensive national and local solid waste management and implement measures to reduce and manage the growing solid waste problem in the country. The Act mandates establishing and operationalizing sanitary landfills as a final disposal site. The act was later amended by RA 11898 or the Extended Producer Responsibility Act of 2022.
- **Republic Act No. 9275** – Philippine Clean Water Act of 2004 was enacted for the purpose of protecting and preserving, and management of the country's water resources from pollution and meeting the set water quality standards and regulations.
- **Republic Act No. 9513** - Renewable Energy Act of 2008 was enacted to support the mainstreaming, adoption, development, and increased utilization of renewable energy sources in the energy mix in the country.

Other climate-related laws enacted highlighted the commitment of the country to strengthen disaster preparedness, response, and recovery, scale up environmental conservation and protection, and just transition to a green economy.

- **Republic Act No. 10121** – Philippine Disaster Risk Reduction and Management Act of 2010 was enacted to strengthen the capacity of national and local governments in implementing measures to prepare, respond and recover from disasters. The Act also established the National Disaster Risk Reduction Management Council (NDRRMC), composed of representatives from the government, private sectors, civil society organizations, and other stakeholders and which served as oversight in the formulation of Disaster Risk Reduction policies, plans and measures.
- **Republic Act No. 10771** – Philippine Green Jobs Act of 2016 aims to scale up and promote sustainable growth and decent job creation and guide the transition into a green economy. The Act established incentive mechanisms for companies to generate and sustain green jobs.
- **Republic Act No. 11038** – Expanded National Integrated Protected Areas System Act of 2018 was enacted to enhance further efforts in the conservation and protection of Protected Areas (PA).
- **Republic Act No. 11285** – Energy Efficiency and Conservation Act of 2019 was enacted to institutionalize energy efficiency and conservation measures in the country



- **Republic Act No. 11697** – Electric Vehicle Industry Development Act was enacted to provide an enabling environment in the development, promotion, and adoption of the use of electric vehicles (EV) in the country. The act also mandates the formulation of the Comprehensive Roadmap for the Electric Vehicle Industry (CREVI), which outlines the EV industry’s plan to accelerate the development, commercialization, and utilization of EVs in the country.
- **Republic Act No. 11898** – Extended Producer Responsibility Act of 2022 was enacted to reduce the number of plastic waste in the country. The Act requires companies to implement programs to recover a percentage of their plastic packaging waste and submit an annual compliance report.

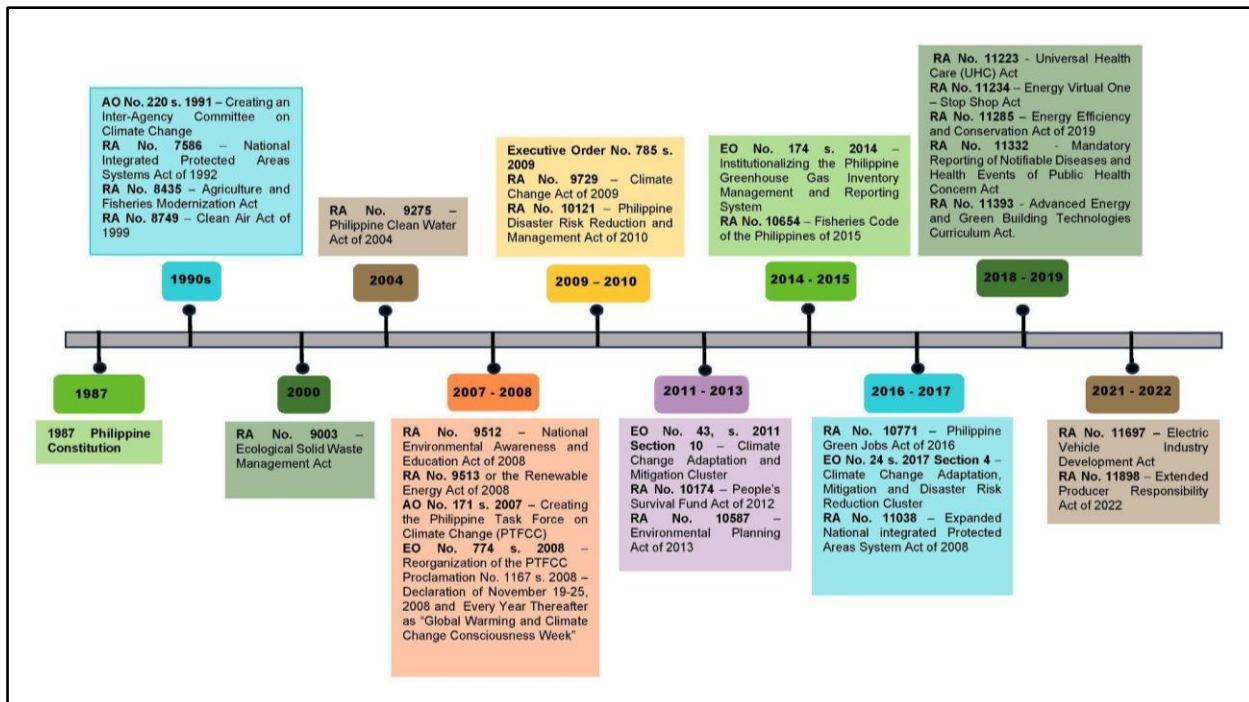


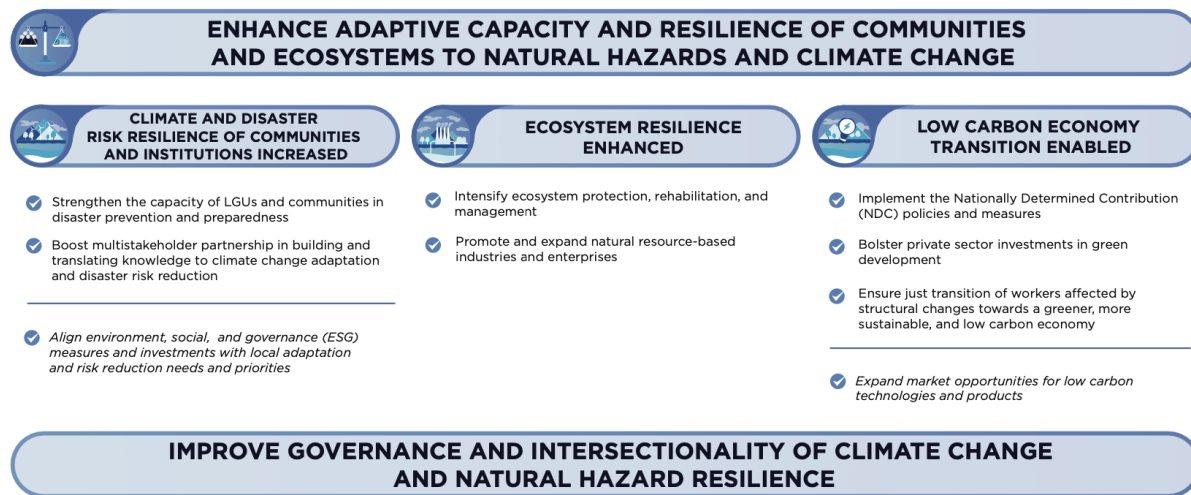
Figure 2.4.1 Philippine Climate Change-Related Laws and Policies (1987 - 2022)

Note: The list of climate-related laws and policies is not exhaustive

The Philippine government has adopted the **Philippine Development Plan (PDP) 2023-2028** as the guide in development planning and socio-economic policies, strategies, and programs. It has a dedicated chapter for climate change - **Chapter 15: Accelerate Climate Action and Strengthen Disaster Resilience**, which outlines strategies for enhanced adaptive capacity and resilience through: 1) increased climate and disaster risk resilience of communities and institutions, 2) enhanced ecosystem resilience, and 3) enabling low carbon economy transition.



Figure 15.1 Strategy Framework to Accelerate Climate Action and Strengthen Disaster Resilience



Note: Strategies above the dashed lines require action by government entities, and those below by non-government entities.

Figure 2.4.2 PDP 2023-2028 Chapter 15 Strategy Framework

Figure 2.4.3 provides the framing of the NAP vis-a-vis the various Philippines' climate change plans and frameworks relative to its respective timeframe.

Guided by the Ambisyon Natin 2040 or the long-term vision of the Philippine government for socioeconomic development, the PDP functions as a medium-term socioeconomic blueprint that is updated every 6 years. The updated PDP is expected to incorporate climate change considerations, aligning development goals with climate resilience.

The NFSCCC, which articulates the country's approach to climate change, serves as a long-term framework which is expected to be updated into a Long-term Strategy (LTS) to align with the evolving climate priorities, following the completion of the NDC Implementation Plan (NDCIP) and the NAP, given their targeted strategies within the stated long-term horizons.

The gathered feedback from implementing the NAP and NDC will logically and systematically inform the updating of the NCCAP within a period before 2028, as its current timeline provides. The challenges and opportunities and gains from the implementation of NAP and NDC will enrich the finetuning of long-term program and strategies for climate change adaptation and mitigation, that will be set to be monitored annually and evaluated every three (3) years, through a reconfigured Monitoring, Reporting, and Verification (MRV) system.

Operationally, the elements of the updated NCCAP will be managed based on the iterative results and practical evidence gathered from the NDC and NAP. Specifically, the results of evaluation of the NDC and NAP will inform the review and updating of the subnational, sectoral, and local plans such as the Local Climate Change Action Plan (LCCAP), ensuring that adaptation strategies and plans are aligned with the broader national climate action agenda, including both mitigation and adaptation efforts.

In conclusion, the Philippines has a multi-tiered approach to climate change planning and policy development, ranging from short-term to long-term documents. This allows the country to address



both immediate and future climate challenges while integrating climate considerations into broader development objectives.

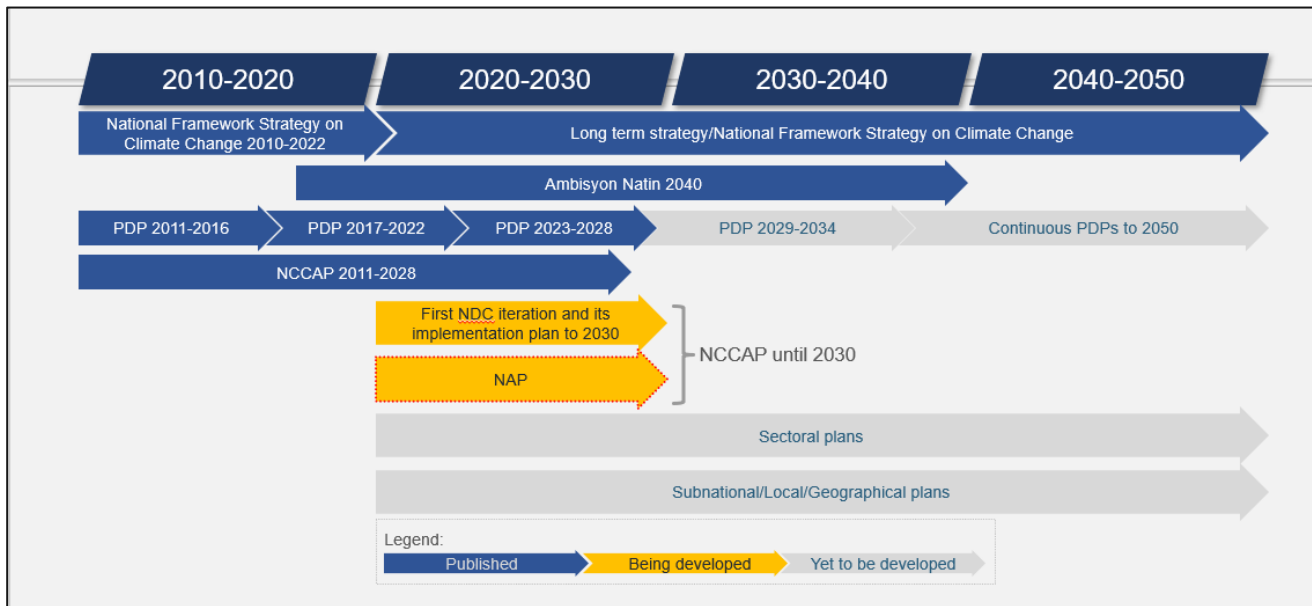


Figure 2.4.3 Philippine Climate Change Plans and Frameworks



Climate Change in the Philippines

Chapter

03



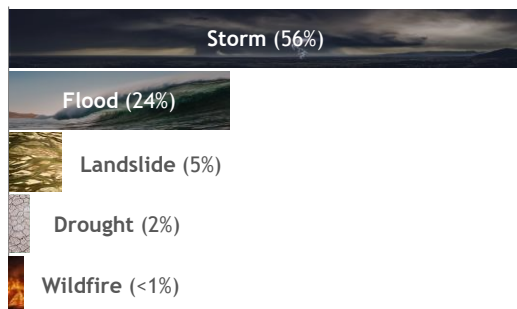
3. Climate Change in The Philippines

3.1 Introduction

This chapter of the National Adaptation Plan (NAP) examines historical climate trends, possible future climate scenarios and the implications to the Philippines from a physical, social and economic perspective. This is followed by a discussion on social vulnerability and the underlying impact-drivers.

To comprehensively grasp the implications of climate change in the Philippines, weather patterns and acute climate events that have the most impact on the country were considered, specifically concentrating on four Critical Impact Domains (CIDs) deemed most critical to the Philippines' vulnerability (see figure 3.1.1). These CIDs have also been selected in consultation with national climate experts (i.e., National Panel of Technical Experts and Consultative Group of Experts for the Philippines' NAP development). These CIDs include **increased temperatures and drought, sea level rise and extreme sea levels, extreme precipitation, and extreme wind and tropical cyclones** (see table 3.1.1).

Top acute climate-related events in the Philippines¹



Chronic climate events

Sea level rise of 5.7-7.0mm/yr during the period 1993 to 2015 was at least two times faster than the global mean average of 2.8-3.6 mm/yr observed between 1993 to 2010

Key Climatic Impact-Drivers (CIDs)²

Increased temperature and drought

Sea level rise and extreme sea levels

Extreme precipitation

Extreme winds and tropical cyclones

Figure 3.1.1: Climatic Impact Drivers relevant for the Philippines

- 1: Size of bar corresponds to % of total annual natural hazards occurrence during 1990 -2018
2. Aligned with National Panel of Technical Experts (NPTE)'s identified top climate risks for the Philippines
3. Based on satellite observations (AVISO altimetry data) taken from 1993 to 2015, the sea level has risen by as much as 5.7-7.0 mm/yr over the Philippine Sea. Such rate is approximately double the highest global average rate of 2.8-3.6 mm/yr, which was observed between 1993 to 2010

Source: BCG analysis on: Climate Watch. (n.d.). Philippines (PHL) Country Profile. Retrieved Month Day, Year, from https://www.climatewatchdata.org/countries/PHL?end_year=2020&start_year=1990.



PAGASA. (2018). Observed Climate Trends and Projected Climate Change in the Phils 2018 [Report]

Table 3.1.1 Description and importance of selected CIDs in the Philippines

CID	Brief Description	Importance in the Philippines
Increased temperature and drought	Increased temperature - Episodic high surface air temperature events potentially exacerbated by humidity Drought - An exceptional period of water shortage for existing ecosystems and the human population (due to low rainfall, high temperature and/or wind)	The Philippines, with substantial outdoor activities, faces the ramifications of increased temperature events and droughts, bearing significant socio-economic consequences. These span from human well-being, labor efficiency, and economic operations. Furthermore, any further temperature escalation pushes us into the hazardous range of the heat index, intensifying the urgency of addressing these challenges.
Sea level rise and extreme sea levels	Sea Level Rise - Chronic and long-term increase of sea levels considering factors such as sterodynamic sea levels, glaciers, land water storage, icesheets and subsidence Extreme Sea Levels - Acute, temporary and short term increase of sea levels such as storm surge, astronomical tides, waves and swash	The Philippines has a vast coastline and numerous low-lying areas, making it vulnerable to sea level rise and extreme sea levels, which can result in coastal flooding (flooding driven by episodic high coastal water levels that results from a combination of relatives sea level rise, tides, storm surge and wave setup) and coastal erosion (long term or episodic change in shoreline position caused by relative sea level rise, nearshore currents, waves and storm surge).



Extreme precipitation	An exceptional period of water shortage for existing ecosystems and the human population (due to low rainfall, high temperature and/or wind) Pluvial flooding - Inundation of land and urban areas caused by heavy precipitation, where the excess water cannot be efficiently absorbed or drained due to factors such as impermeable surfaces and inadequate drainage systems Fluvial flooding - Occurs when rivers and streams exceed their capacity and overflow their banks due to intense or prolonged precipitation	The Philippines experiences heavy precipitation, especially during the monsoon season. Extreme precipitation events can cause floods and landslides, leading to loss of life, property damage, loss of agriculture production and disruption of Infrastructure.
Extreme winds and tropical cyclones	Warm-core low pressure systems associated with a spiral inflow of mass at the bottom level and spiral outflow at the top level	The Philippines is highly vulnerable to tropical cyclones, which can cause significant damage to infrastructure, agriculture, and coastal areas, posing a threat to lives.

In this chapter, historical trends and future climate risks for each CID are examined from both global and Philippine-specific perspectives. This approach enhances the understanding of climate risks in the Philippines, which helps support adaptation planning and decision-making processes through identifying the most impacted areas in the Philippines.



3.2 Historical climate trends

Human-induced climate change is already affecting many weather and climate extremes in every region across the globe. This discussion will specifically focus on historical climate trends, particularly those related to the identified key Climactic impact drivers (CIDs). Evidence of observed changes in extremes such as heatwaves, heavy precipitation, droughts, and intensifying tropical cyclones, and their attribution to human influence, has become more compelling. As the urgency of addressing human-induced climate change grows to meet the goals of the Paris Agreement, the impacts are being felt across various regions and climates, including the Philippines.

The Philippines is one of the world's most vulnerable countries to the impacts of climate

Ranked 1st on the World Risk Index in 2022 among 193 countries worldwide, the country is continuously exposed to often catastrophic extreme weather events, such as devastating tropical cyclones (Luz, 2022). Most areas of the country and 74 percent of the population are at risk and vulnerable to climate-induced disasters (*World Bank Climate Change Knowledge Portal*, n.d.). High levels of disaster risk are associated with more intense tropical cyclones, including heavy precipitation and floods, sea level rise, and extreme heat and droughts. As a result, both rural and agricultural systems, along with numerous other sectors in the country, are facing a growing vulnerability to climate-related risks, including the cascading impacts of extreme weather events, leading to substantial losses and damages.

In general, the country has four major climate types based on rainfall distribution (see Figure 3.2.1).

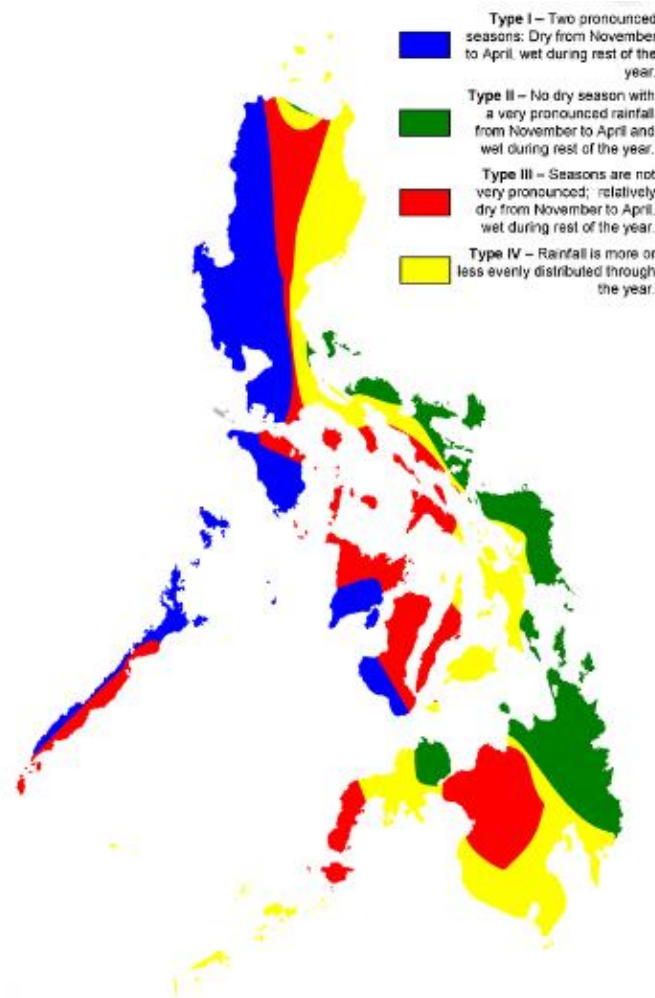


Figure 3.2.1: Four climate types of the Philippines based on Modified Coronas Classification System

Data source: Oscar M. Lopez Center for Climate Change Adaptation and Disaster Risk Management Foundation, Inc. (Oscar M. Lopez Center) and Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), 2023. State of the 2020 Philippine Climate, January 2023.

The country has an extensive coastline of 36,289 km surrounded by the Philippine Sea and the Pacific Ocean on the east, the West Philippine Sea on the west, and the Sulu and Celebes Seas on the south (“Philippine Climate Change Assessment,” 2016). The islands of Luzon and Mindanao have a complex topography consisting of plains, hills, valleys, and high mountains ranging up to 3 km (~2.95 km for Mt. Apo) (“Philippine Climate Change Assessment,” 2016). However, most of the smaller islands also have mountainous areas (“Philippine Climate Change Assessment,” 2016). All these geographic features play an important role in defining the climate profile of the country.



3.2.1 Increased temperature and drought

Global trends

Human influence since the 1950s has significantly increased the likelihood of compound extreme events, such as simultaneous heatwaves and droughts, as well as elevated fire weather in specific regions across all inhabited continents.

Over the past four decades, each decade has been consistently warmer than the one preceding it since 1850 (IPCC, 2021). The global surface temperature from 2001 to 2020 was approximately 0.99°C higher than during 1850-1900 (range: 0.84 to 1.10°C) (IPCC, 2021). Specifically, the temperature increases from 2011 to 2020 was around 1.09°C higher than 1850-1900 (range: 0.95 to 1.20°C), with greater land warming (approximately 1.59°C, range: 1.34 to 1.83°C) compared to ocean warming (about 0.88°C, range: 0.68 to 1.01°C) (IPCC, 2021). This rise is primarily due to continued warming since 2003-2012 (+0.19°C, range: 0.16 to 0.22°C) (IPCC, 2021).

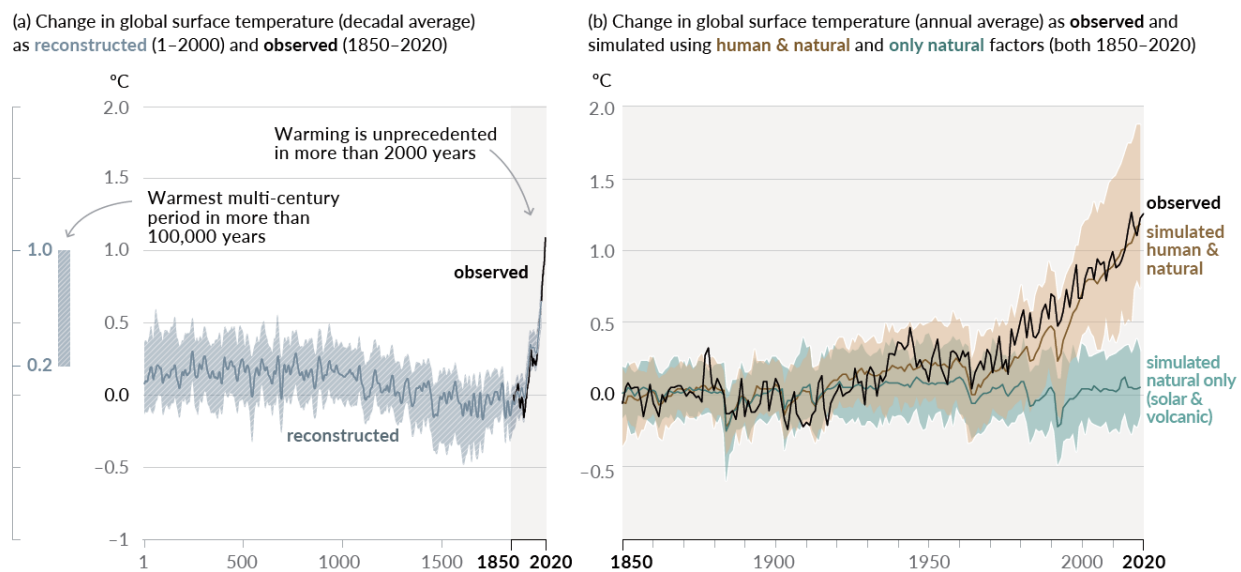


Figure 3.2.1.1: Changes in global surface temperature relative to 1850–1900

Data source: IPCC, 2021: Summary for Policymakers. In: *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (Figure SPM.1)*

Consequently, the average temperature has been increasing more in the recent years. Globally, the year 2020 ranked as the second warmest year on record. The warmest years on record have all taken place consecutively (2015 to 2020) and in the past decade (Oscar M. Lopez Center & PAGASA, 2023). In Asia, 2020 is also notable for recording the region's first temperature anomaly exceeding 2 °C. Except for 2007, Asia's warmest years have also taken place recently (Oscar M. Lopez Center & PAGASA, 2023). For the Philippines, 1998 remains to be the hottest year since 1950 with a 1 °C



temperature anomaly, as a result of the 1997-98 El Niño. 2020 ranked 4th along with 2019 (Oscar M. Lopez Center & PAGASA, 2023). The country's warmest years all occurred in the last two decades.

RANK	GLOBAL baseline period: 1901-2000	ASIA baseline period: 1901-2010	PHILIPPINES baseline period: 1991-2020
1	2016	2020	1998
2	2020	2015	2016, 2010
3	2019	2017	2019, 2020
4	2015	2007	2015, 2006
5	2017	2019	2018, 2012, 2007, 2005, 1988

Figure 3.2.1.2: Top warmest years globally, and specifically for Asia and the Philippines

Data source: Oscar M. Lopez Center for Climate Change, Adaptation and Disaster Risk Management Foundation, Inc. (Oscar M. Lopez Center) and Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), 2023. State of the 2020 Philippine Climate, January 2023.

The impacts of this warming trend can evidently be observed through the occurrence of hot extremes and droughts in nearly all regions worldwide, including Southeast Asia (SEA hexagon in Figure 3.2.1.3). Many of these extreme events can be attributed to human influence.

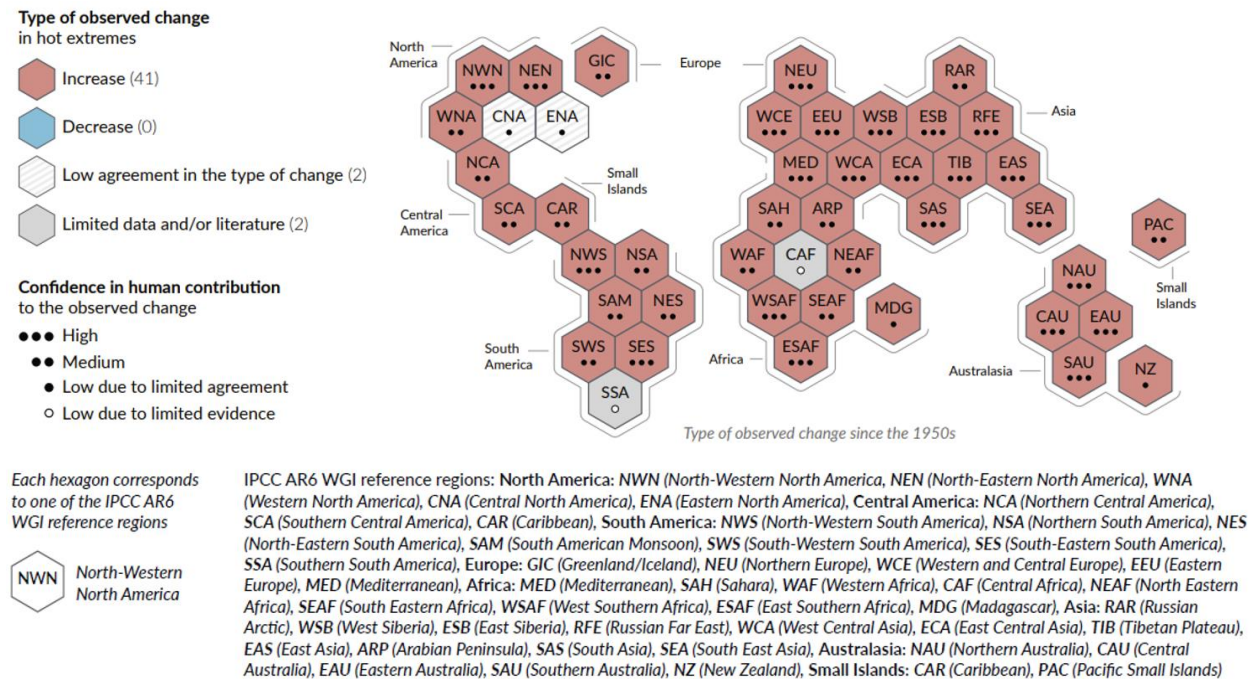


Figure 3.2.1.3: Observed change in hot extremes⁴⁷ with confidence in human contribution in each of the world's region

Data source: IPCC, 2021: Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (Figure SPM.3)

Philippine trends

Compared to global trends, the Philippines has experienced significant impacts from extreme heat.

The Philippines is experiencing a 0.1 °C per increase in temperature per decade

Since the 1980s, the Philippines has been observing higher-than-normal temperatures. Over the past 69 years, the country's annual mean temperature has risen by 0.75 °C (Oscar M. Lopez Center & PAGASA, 2023). There is also an interannual variability with an increasing trend of 0.1 °C per decade.

⁴⁷ The evidence for hot extremes primarily relies on the analysis of metrics related to daily maximum temperatures. In addition, regional studies that examine indices such as heatwave duration, frequency, and intensity are considered. Regions with observed increases in hot extremes, indicated by red hexagons, demonstrate at least a medium level of confidence.

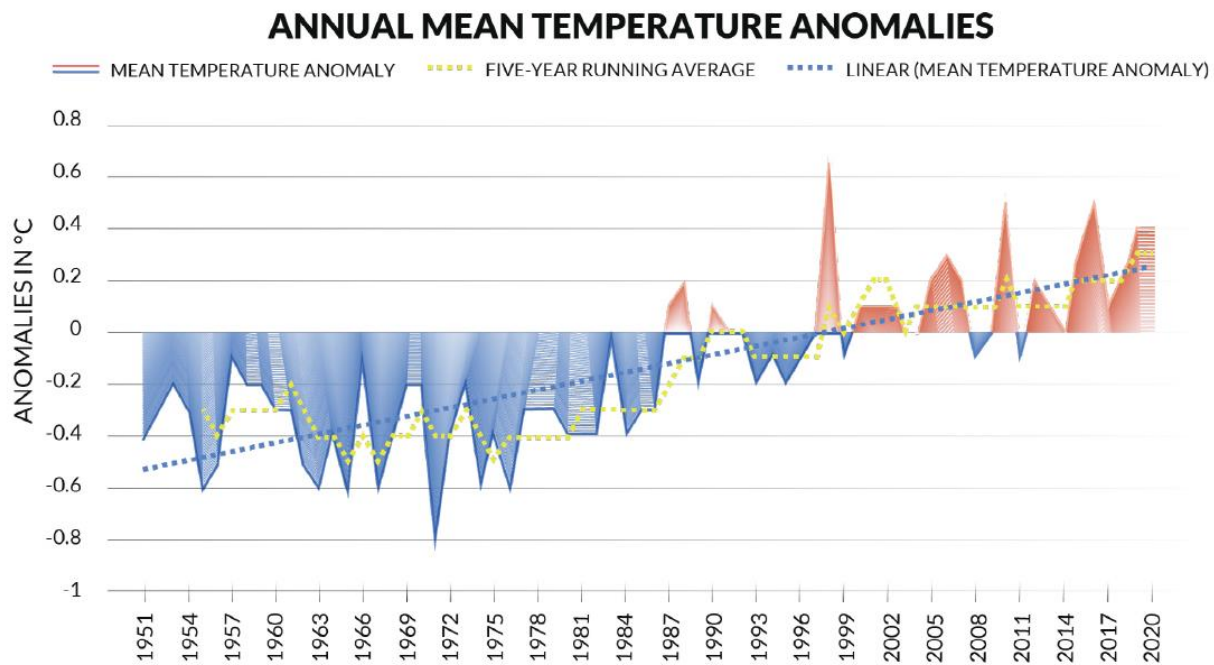


Figure 3.2.1.4: National annual average mean temperature anomalies from 1951 to 2020 (relative to 1991-2020 normal)

Data source: Oscar M. Lopez Center for Climate Change Adaptation and Disaster Risk Management Foundation, Inc. (Oscar M. Lopez Center) and Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), 2023. State of the 2020 Philippine Climate, January 2023.

While daytime (maximum) and nighttime (minimum) temperature anomalies also display variability, both continue to exhibit an increasing trend (Oscar M. Lopez Center & PAGASA, 2023). However, the annual maximum temperature has experienced a slower rate of increase, at approximately 0.1 °C per decade over the last four decades. On the other hand, the annual minimum temperature has seen a more rapid increase of 0.15 °C per decade (Oscar M. Lopez Center & PAGASA, 2023).

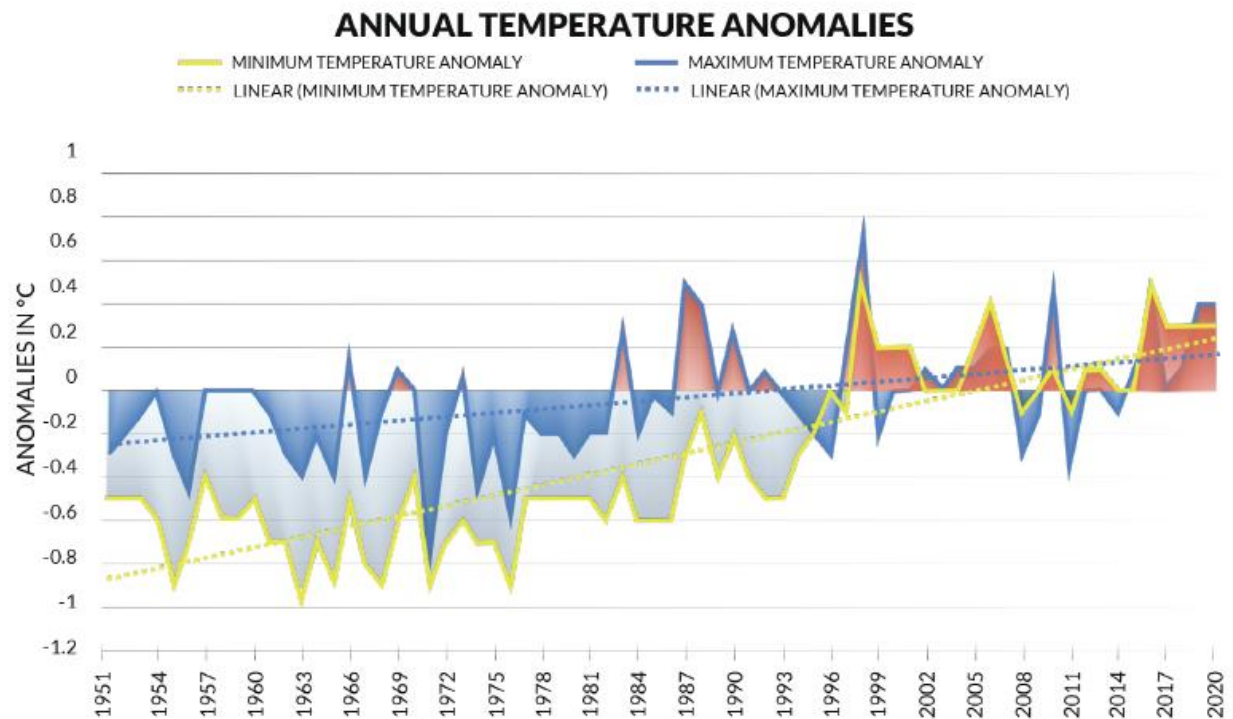


Figure 3.2.1.5: National annual maximum and minimum temperature anomalies from 1951 to 2020 (relative to 1991-2020 normal)

Data source: Oscar M. Lopez Center for Climate Change Adaptation and Disaster Risk Management Foundation, Inc. (Oscar M. Lopez Center) and Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), 2023. *State of the 2020 Philippine Climate*, January 2023.

Droughts are intensified by El Niño events and threaten critical economic activities such as agricultural production

Droughts, which can be intensified by El Niño events, exposes the country to significant losses in many types of crops in which water availability limits yield. A notable instance that exemplifies this impact is the 1997-1998 El Niño episode (Villafuerte M *et al.*, 2021). During this period, a substantial shortage of precipitation caused by the El Niño event led to a significant decline in rice production nationwide (Villafuerte M *et al.*, 2021). This drought period, experienced from late 1997 to early 1998, shows that El Niño-driven droughts and losses in rice production, affecting both rainfed and irrigated rice ecosystems in the Philippines (see Figure 3.2.1.6) (Villafuerte M *et al.*, 2021). Implementing effective measures to address and mitigate the impacts of droughts and El Niño events is crucial for safeguarding rice production and ensuring food security in the country.

The El Niño season also has adverse economic consequences. In 2010, El Niño triggered droughts that resulted in approximately \$240 million (P13 billion) worth of damage to rice crops in the Philippines (Baclig, 2023).

During the 2015-2016 period, prolonged El Niño conditions lasting 18 months affected approximately one-third of the country (Baclig, 2023). Over 400,000 farmers and 550,000 hectares of land were



directly impacted by El Niño-induced drought. The event caused agricultural production losses amounting to \$327 million (P17.78 billion) (Baclig, 2023). Retrospectively, national GDP losses of \$3.3 billion (P179 billion) as a result of such El Niño event (Baclig, 2023)

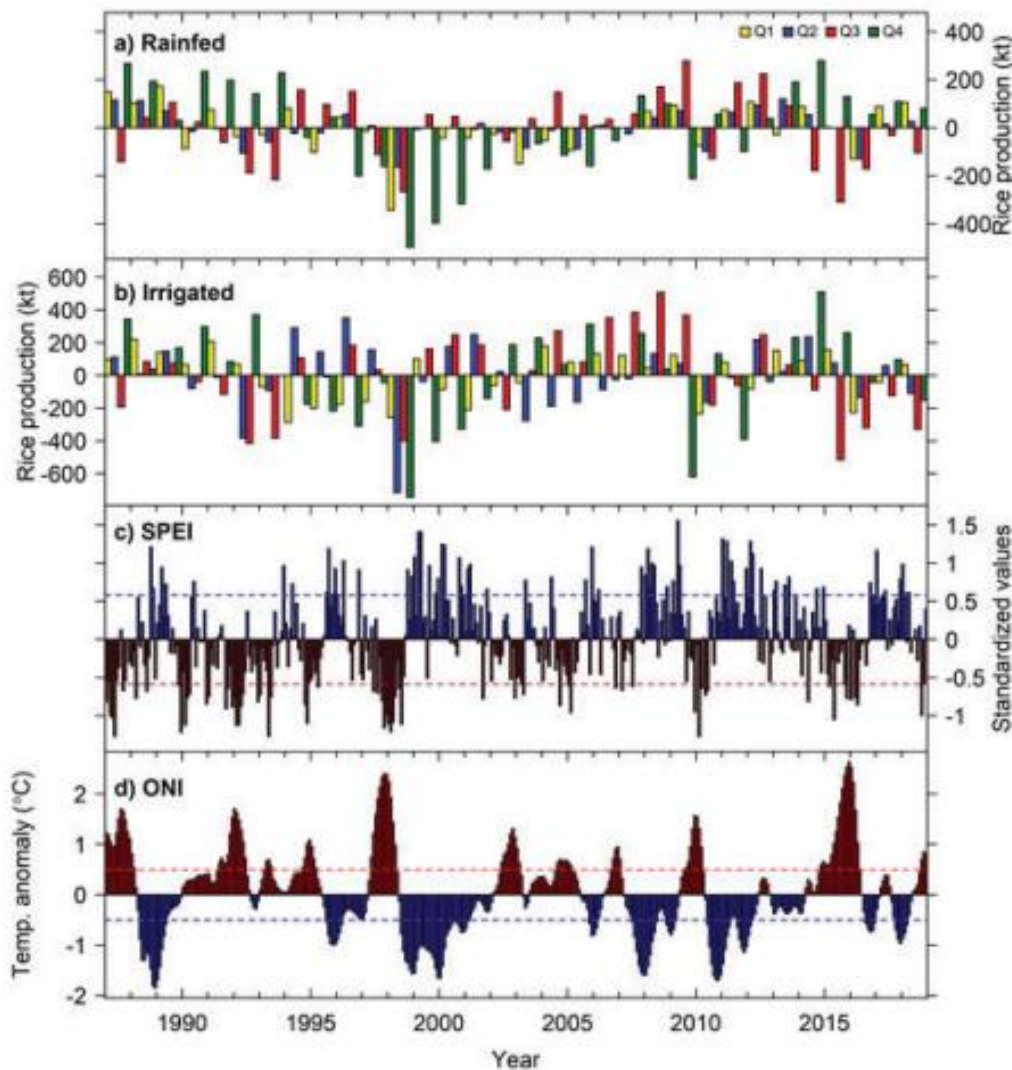


Figure 3.2.1.6: Time series of detrended seasonal rice production in a) rainfed ecosystem and b) irrigated ecosystem aggregated across all the provinces of the Philippines. The time series of monthly SPEI is also shown in c), in which positive (negative) SPEI values indicate rainfall surplus (deficit) in the country. The oceanic Niño 3.4 index in d). The “Q1” in a) and b) refers to the first quarter of the year (i.e., January–March), “Q2” as the second quarter (i.e. April–June), “Q3” (July–September), and “Q4” (October–December).

Source: Villafuerte M et al. 2021. *ClimDatPh: an Online Platform for Philippine ClimateData Acquisition* (Figure 5)



Impact of increased temperature and drought to the Philippines

The rising temperatures in the Philippines pose significant risks to both public health and the economy, as indicated by the impacts observed in recent years.

According to UNICEF, in 2020, an estimated 1.1 million children in the Philippines were affected by frequent high heat occurrences, with 4.5 or more heatwaves per year (UNICEF, 2022). Furthermore, at least 1.9 million children experienced prolonged heatwaves lasting 4.7 days or more (UNICEF, 2022). These numbers are expected to increase by 2050, with an anticipated 33.5 million Filipino children (99% of all children in the country) experiencing five or more heatwaves (UNICEF, 2022). Additionally, 26.3 million children (77% of the estimated total) are projected to endure extended heatwave durations (UNICEF, 2022). This places the Philippines at rank 31 of 163 countries in terms of UNICEF's children's climate risk index, indicating that the Philippines is one of the countries where children are most at risk from climate and environmental factors (UNICEF, 2021).

In March 2023, the Philippines' Department of Health (DOH) recorded at least 118 cases of heat exhaustion in Manila alone, with 33 cases originating from four high schools in Valenzuela City (Sarao, 2023).

PH CHILDREN EXPOSED TO EXTREME HEAT		
DATE	CHILDREN EXPOSED TO HIGH HEATWAVE FREQUENCY (4.5 OR MORE HEATWAVES PER YEAR)	CHILDREN EXPOSED TO HIGH HEATWAVE DURATION (4.7 DAYS OR LONGER HEATWAVE)
2020	1.1 million (3%)	1.9 million (5%)
2050*	33.5 million (99%)	26.3 million (77%)
2050**	33 million (99%)	30.6 million (92%)

*Low greenhouse gas emission scenario: 1.7 degrees warming in 2050
 **Very high greenhouse gas emission scenario: 2.4 degrees warming in 2050

Figure 3.2.1.7: Filipino children's exposure to extreme heat

Data source: Graphic from Baclig, C. E. (2023, March 29). Extreme heat in PH: Health risks, economic impact. Original data source: United Nations Children's Fund, The Coldest

Year of the Rest of their Lives: Protecting children from the escalating impacts of heatwaves, UNICEF, New York, October 2022.

Moreover, drought has substantial impacts on the well-being of biodiversity leading to the death of plants and animals, potentially including those on the endangered list. The ENSO-driven droughts cause sea temperatures to increase which causes coral bleaching. Estimates for the 1997-1998



drought report that coral bleaching was widespread, reaching as high as 80% of coral cover in Bolinao (Burke et al. 2002). Red tide outbreaks and fish kills were reported during the 1982-1983, 1991-1992, and 1997- 1998 El Niño periods. Forest fires are also regular in the Philippines during droughts, leading to species loss, increased erosion and dam sedimentation, river siltation, and air pollution⁴⁸.

Conclusion

In conclusion, human influence has amplified the occurrence of compound extreme events globally, including concurrent heatwaves and droughts. Evidently, each successive decade since 1850 has been warmer than the previous one, with noticeable temperature rises in the first two decades of the 21st century.

In the Philippines, temperatures have been increasing at a slightly faster rate than the global average, with variations in temperature anomalies across the country. This warming trend has resulted in adverse impacts on public health, with millions of individuals experiencing heatwaves. Moreover, the economy has been significantly impacted, especially during El Niño-induced droughts, leading to substantial agricultural losses and negative GDP impacts. These circumstances highlight the need for mitigation and adaptation measures.

⁴⁸ Philippines National Drought Plan (2020)



3.2.2 Sea level rise and extreme sea levels

Global trends

Over the course of history, global sea levels have experienced significant changes, as stated in the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report. Global mean sea level has risen faster since 1900 than over any preceding century in at least the last 3000 years (IPCC, 2023). From 1901 to 2018, the global mean sea level rose by 0.20 meters [0.15 to 0.25], with varying rates observed during different time periods (IPCC, 2023). Between 1901 and 1971, the average rate of sea level rise was 1.3 millimeters per year, which then increased to 1.9 millimeters per year from 1971 to 2006 (IPCC, 2023). However, from 2006 to 2018, the rate surged to 3.7 millimeters per year, indicating a faster pace of increase (IPCC, 2023).

Human influence has been identified as the primary driver of sea level rise since at least 1971 (IPCC, 2023). The impacts of climate change, such as the warming of the oceans and the melting of ice sheets, have contributed to this phenomenon (IPCC, 2023). The consequences of sea level rise are expected to persist for centuries to millennia due to ongoing processes like deep ocean warming and ice sheet melt (IPCC, 2023). As a result, global mean sea level will continue to rise, with significant regional variations projected along most coastlines (IPCC, 2023). This is true even if global temperature increases were to stop immediately because of the inherent time lag in the Earth's climate system.

Philippine trends

Southeast Asia is often considered especially vulnerable to the impacts of sea-level rise and local areas of the Philippines have been experiencing relatively high rates of sea-level rise (DOST-PAGASA, 2018). About 60% of the Philippine population and over 50% of Philippine municipalities, including the country's capital, Manila, are located in the coastal zone (*ONEOCEAN Informations*, n.d.).

SLR in the Philippines double the global average

Satellite observations (AVISO altimetry data) spanning 1993 to 2015 reveal a significant sea level rise of 5.7-7.0 mm/yr over the Philippine Sea (DOST-PAGASA, 2018). This rate is approximately twice the highest global average rate of 2.8-3.6 mm/yr observed between 1993 to 2010 (DOST-PAGASA, 2018). The disparity can be attributed to natural climate-related phenomena, such as the El Niño Southern Oscillation (ENSO), which directly impacts the tropical Pacific region (DOST-PAGASA, 2018).

Heightened SLR in specific locations

Diverse patterns emerge when examining coastal areas in the Philippines, highlighting notable differences in sea level rise rates (DOST-PAGASA, 2018). Specifically, the eastern islands of Leyte and Samar, as well as the southwestern coasts of the Central and Western Visayas, and areas east of Mindanao and south of Zamboanga, face a significant annual sea level rise ranging from 4.5 to 5.0mm (see Figure 3.2.2.1) (DOST-PAGASA, 2018).



Moreover, specific coastal regions exhibit distinct changes, as depicted in Figure 3.2.2.1. Analyzing tide gauge data from the National Mapping and Resource Information Authority (NAMRIA), Manila has experienced a rapid increase in sea level, primarily attributed to long-term land subsidence caused by excessive groundwater extraction (DOST-PAGASA, 2018). In contrast, Legazpi and Davao have witnessed gradual sea level rises, while no clear trend has been observed in Cebu and Jolo, Sulu (see Figure 3.2.2.2) (DOST-PAGASA, 2018).

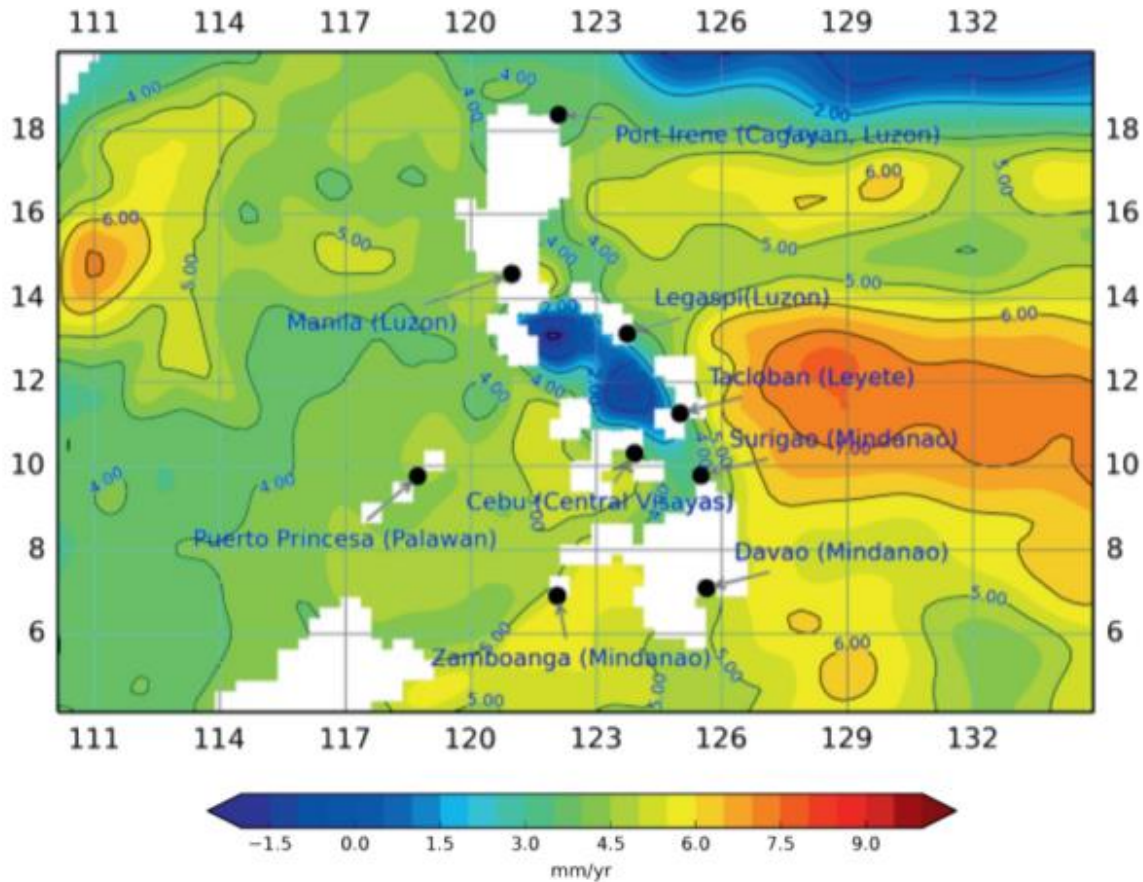


Figure 3.2.2.1: Sea level changes in the Philippines region from 1993-2015

Data source: DOST-PAGASA, 2018: *Observed and Projected Climate Change in the Philippines*. Philippine Atmospheric, Geophysical and Astronomical Services Administration, Quezon City, Philippines, 36 pp.

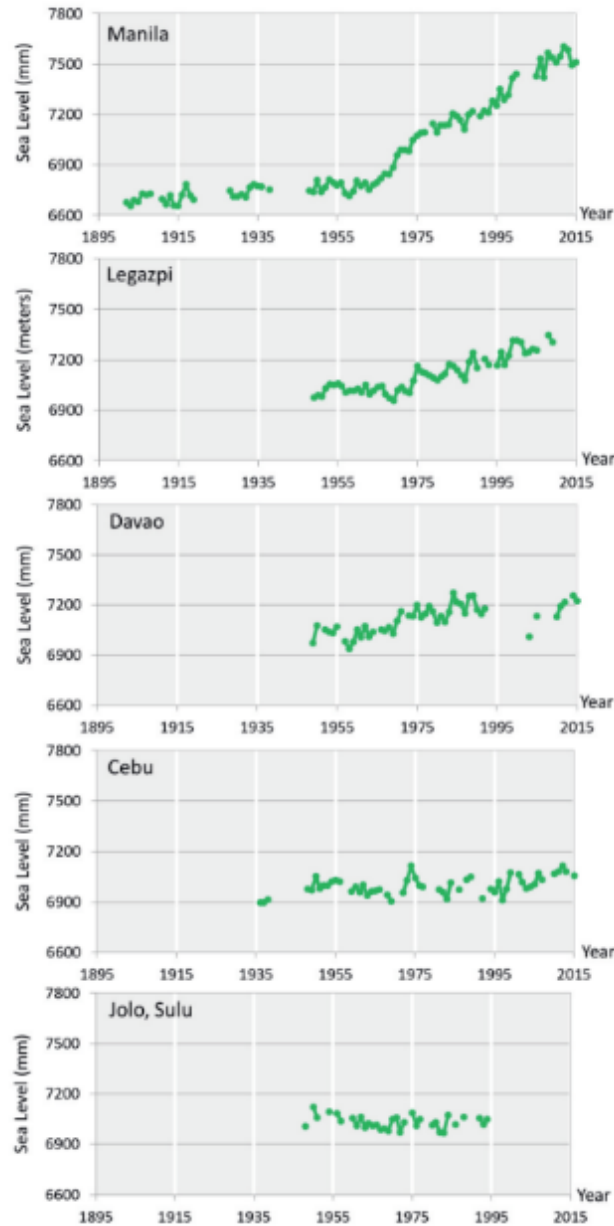


Figure 3.2.2.2: Sea level rise in selected areas (in mm) above the Revised Local Reference level (7,000 mm) Data source: DOST-PAGASA, 2018: Observed and Projected Climate Change in the Philippines. Philippine Atmospheric, Geophysical and Astronomical Services Administration, Quezon City, Philippines, 36 pp.



Mean sea level in Manila has been increasing at an average rate of 1.3 mm per year since the 1900s, which increased to about 2.6 cm per year in the 1960s (“Philippine Climate Change Assessment,” 2016). Figure X shows the increasing trends in sea level, as well as in Metro Manila groundwater use that has enhanced land subsidence in the city (“Philippine Climate Change Assessment,” 2016).

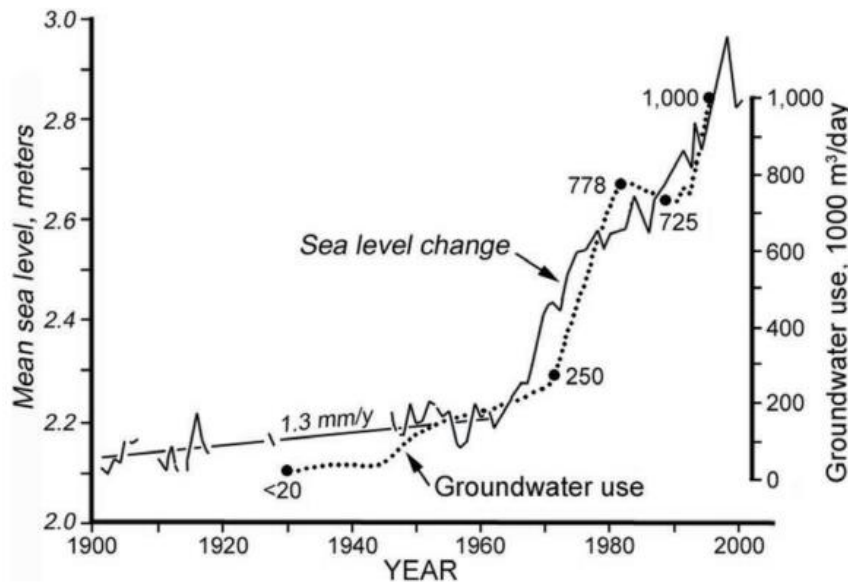


Figure 3.2.2.3: Combined plot of sea level change at Manila South Harbor and groundwater use in Metro Manila from 1902 to 2000

Data source: Philippine Climate Change Assessment. (2016). In *climate.gov.ph*. The Oscar M. Lopez Center for Climate Change Adaptation and Disaster Risk Management Foundation Inc. (Figure 5.4)

Land subsidence exacerbates impact of SLR

The implications of rising sea levels are compounded by the occurrence of land subsidence in certain areas, exacerbating the impact of sea level rise and leading to increased vulnerability to flooding and extreme sea levels. This relationship becomes apparent when considering the subsidence zones identified in the Philippines.

Research utilizing satellite data at an approximate resolution of 80 meters has revealed a significant correlation between subsidence zones and regions with high groundwater usage (refer to Table 3.2.2.1 and Figure 3.2.2.4). Notably, regions IV-B (MIMAROPA), III (Central Luzon), VII (Central Visayas), and XI (Davao Region) exhibit multiple clusters of subsidence zones, indicating the vulnerability of these areas to land subsidence. Given this understanding, an important adaptation strategy for reducing the effects of sea level rise and flooding in these vulnerable areas would be to manage water (including groundwater) usage effectively.



WATER RESOURCES REGION	ALLOCATED WATER (CONSUMPTIVE USE) (MCM/YR)
IV	838
III	733
VII	205
VI	190
XI	183
XII	150
X	108
II	64
V	55
I	53
VIII	30
IX	20

Table 3.2.2.1: Top regions with regard to groundwater usage from 2021-2023

Data Source: Boston Consulting Group. (2023). Data Model on Land subsidence [Data model]. Retrieved from Alaska satellite facility database.

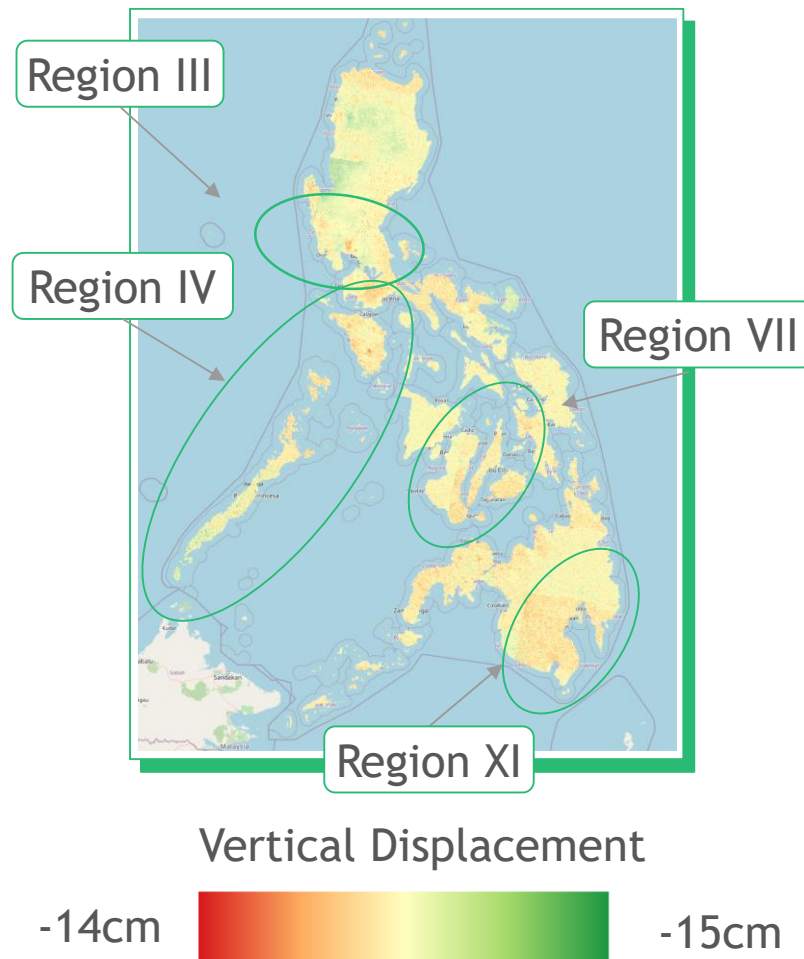


Figure 3.2.2.4: Subsidence Zones in the Philippines from 2021-2023

Data Source: Boston Consulting Group. (2023). Data Model on Land subsidence [Data model]. Retrieved from Alaska satellite facility database.



Impact of SLR on the Philippines

Sea level rise poses a significant threat to the Philippines, particularly in terms of inundation. Even at a lower estimate of one meter sea level rise, approximately 7,000 square kilometers across 2,490 barangays (villages) would be affected, impacting an estimated 1.8 million people (Lauren, 2013). If sea levels were to rise by two meters, the impact would extend to nearly 8,000 square kilometers across 2,730 barangays, affecting an estimated 2.3 million people (Lauren, 2013). The most catastrophic scenario, with a three-meter sea level rise, would have far-reaching consequences, affecting over 15,000 square kilometers across 5,387 barangays and impacting an estimated 3.4 million people. Sea level rise also affects natural systems, such as mangrove degradation, coral reef bleaching, and saltwater intrusion. The scale of these potential impacts underscores the urgency of addressing and mitigating the risks associated with rising sea levels (Lauren, 2013).

Conclusion

In conclusion, the analysis of global sea level trends and the specific context of the Philippines highlight the pressing challenges posed by sea level rise. The Intergovernmental Panel on Climate Change (IPCC) Assessment Report 6 reveals that global mean sea level has risen at an unprecedented rate since 1900. Human-induced factors, such as climate change and the subsequent warming of the oceans and melting of ice sheets, are primarily responsible for this phenomenon. The Philippines, with its extensive coastline and numerous coastal cities, is especially vulnerable to the impacts of sea level rise. Specific areas with noticeably high population density, such as Manila, experience higher rates of sea level rise. These changes have the potential to inundate vast areas and affect millions of people, emphasizing the urgent need to address the risks associated with rising sea levels. By implementing effective adaptation strategies, the Philippines can work towards safeguarding its coastal communities and preserving its natural and economic resources for future generations.



3.2.3 Extreme precipitation

Extreme precipitation refers to unusually heavy rainfall over a set duration compared to the norm in a certain region. This can lead to landslides, pluvial and fluvial floods, and significant water accumulation, posing risks to infrastructure, communities, and ecosystems.

Global trends

The changing climate has had a significant impact on precipitation patterns across the globe, with observable trends indicating an increase in the frequency and intensity of heavy precipitation events since the 1950s (IPCC, 2023). Extensive observational data supports this trend analysis, providing high confidence that human-induced climate change is the primary driver of these changes (IPCC, 2023).

Furthermore, scientific studies focusing on event attribution and physical understanding have consistently shown that human-induced climate change plays a crucial role in intensifying heavy precipitation associated with tropical cyclones (IPCC, 2023). The link between human activities and the increased intensity of these extreme weather events is supported by high confidence (IPCC, 2023).

On a global scale, there is medium confidence that precipitation over land has experienced a likely increase since 1950, with an even faster rate of increase observed since the 1980s (IPCC, 2021). This pattern of precipitation changes since the mid-20th century is believed to be influenced by human activities (IPCC, 2021). Human influence has likely contributed to the observed changes in precipitation patterns, although the level of confidence varies across regions (IPCC, 2021).

Specifically, in Southeast Asia, including countries like the Philippines, there is evidence to suggest that precipitation has increased (IPCC, 2021). The observed changes in precipitation in this region are associated with human influence, although the level of confidence in this contribution may vary (see Figure 3.2.3.1) (IPCC, 2021).

These findings highlight the global impact of climate change on precipitation patterns, particularly in relation to heavy precipitation events. The scientific consensus supports the notion that human activities are the main driver behind these changes, emphasizing the urgent need for adaptation strategies to address the challenges posed by these shifting precipitation patterns.

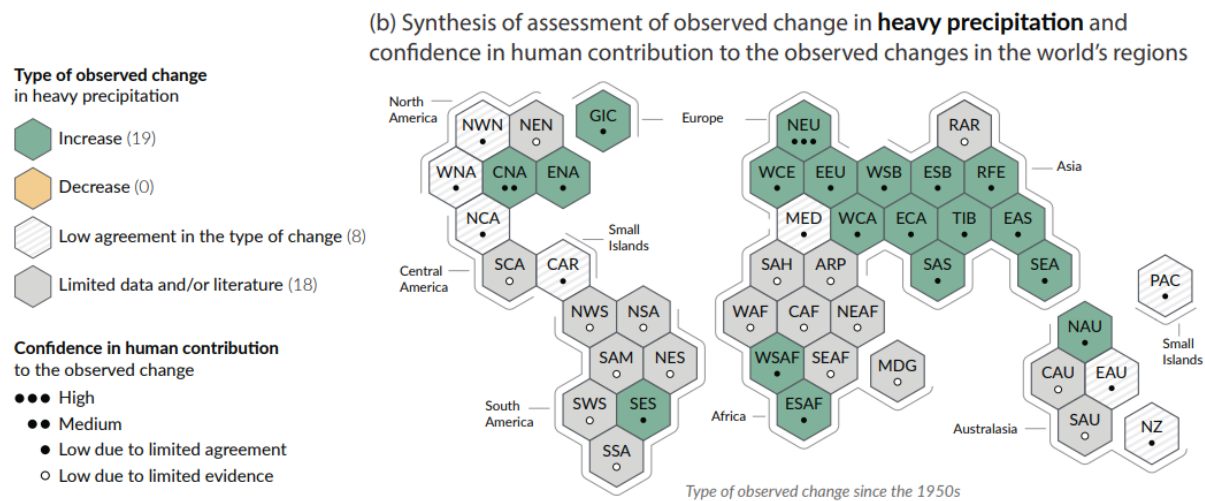


Figure 3.2.3.1: Synthesis of assessment of observed change in heavy precipitation and confidence in human contribution to the observed changes in the world's regions (since 1950s). Green hexagons indicate regions where there is at least medium confidence in an observed increase in heavy precipitation.

Data source: IPCC, 2021: Summary for Policymakers. In: *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (Figure SPM.3)*

Philippine trends

The precipitation patterns in the Philippines exhibit geographic and seasonal variations

The precipitation in the Philippines exhibits a diverse landscape. On average, the country receives around 2,348 millimeters of precipitation annually ("Climate Risk Country Profile: Philippines," 2021). However, there is significant geographic variation, as the mean annual rainfall of the Philippines varies from 965 to 4,064 millimeters annually ("Climate Risk Country Profile: Philippines," 2021). This distribution varies seasonally as well. During the months of June to September, heavy precipitation is concentrated in the western regions of the country, marking a period of increased total precipitation ("Climate Risk Country Profile: Philippines," 2021). Conversely, between October and March, heavy precipitation is predominantly observed in the eastern regions, coinciding with a decrease in the overall precipitation across the country (see Figures 3.2.3.2 and 3.2.3.3) ("Climate Risk Country Profile: Philippines," 2021).

Historically, there have been noticeable changes and trends in precipitation patterns. From 1951 to 2010, an increasing trend in precipitation was observed in the northeastern section of Mindanao and eastern portions of Visayas during the months of December to February, which coincides with the northeast monsoon season (DOST-PAGASA, 2018). These areas are at an increased risk of flooding during this time (DOST-PAGASA, 2018). Similar increasing precipitation trends were observed in central portions of Luzon and northeastern sections of Mindanao in March to May (DOST-PAGASA, 2018). In the following seasons of June to August and September to November, increasing precipitation trends were observed in the Ilocos Region, as well as the northeastern and southern



parts of Mindanao (DOST-PAGASA, 2018). However, most parts of the country experienced a decreasing trend in precipitation (see Figure 3.2.3.4) (DOST-PAGASA, 2018).

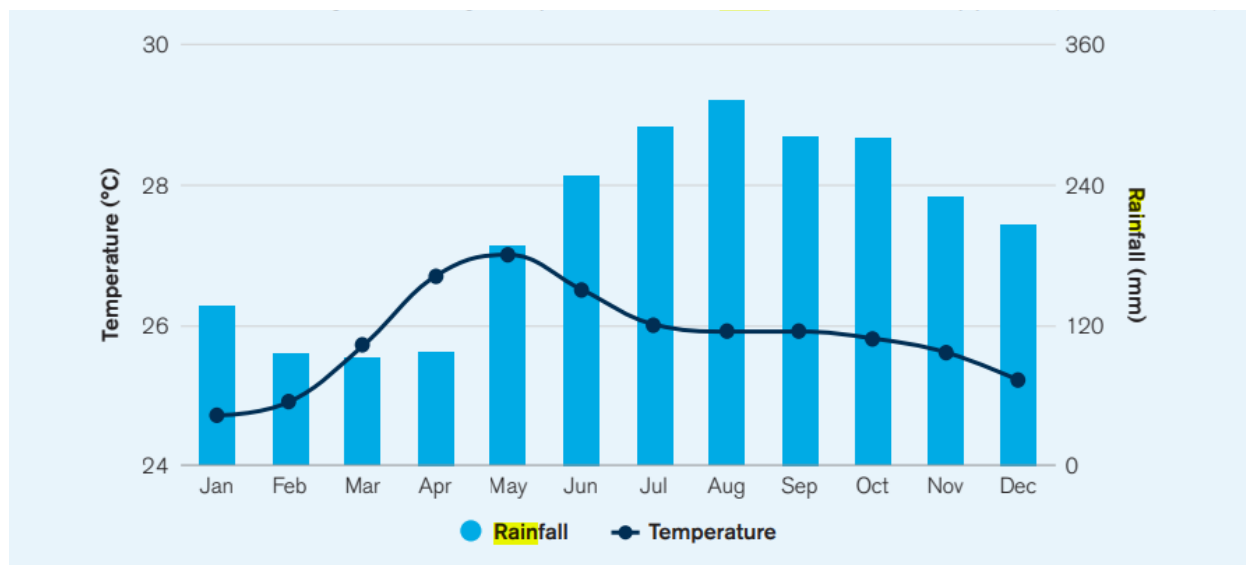


Figure 3.2.3.2: Average monthly precipitation and temperature in the Philippines (1991-2020)

Note: Temperature axis begins at 24°C to enhance visibility of temperature trends and variations

Data source: Climate Risk Country Profile: Philippines (2021): The World Bank Group and the Asian Development Bank (Figure 2)

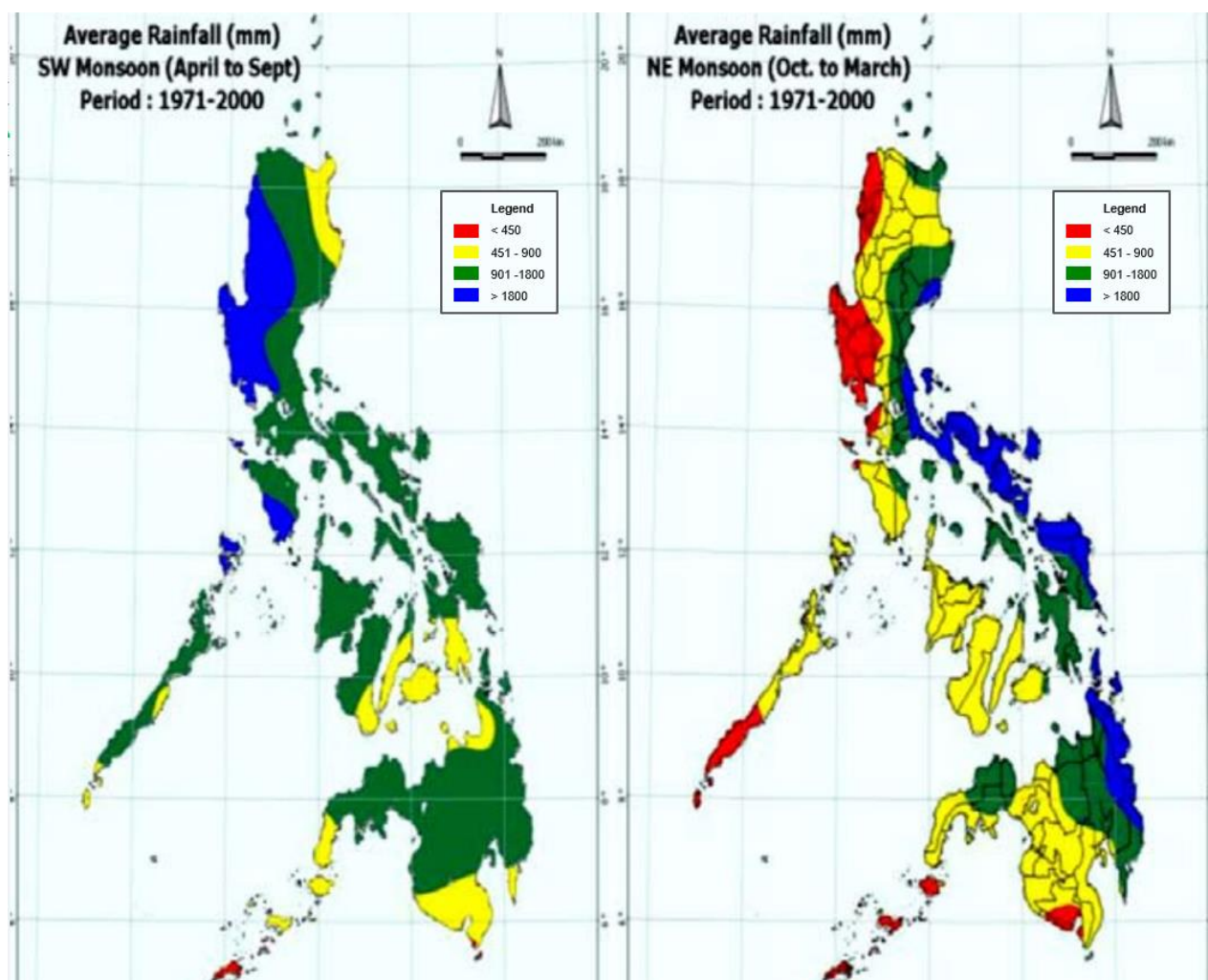


Figure 3.2.3.3: Seasonal precipitation distribution in the Philippines 1971–2000, (left) April to September

and (right) October to March

Data source: *Climate Risk Country Profile: Philippines (2021): The World Bank Group and the Asian Development Bank (Figure 3)*

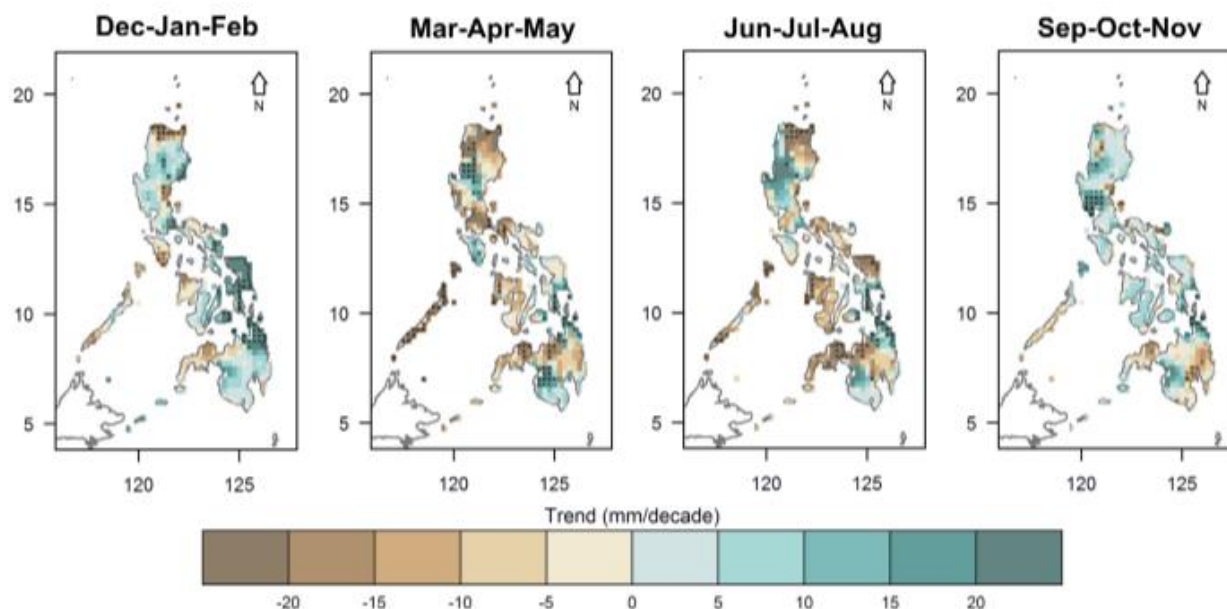


Figure 3.2.3.4: Observed trends in seasonal total precipitation in the Philippines during the period from 1951-2010. Areas marked with dots denote statistical significance at 5% based on Mann-Kendall test

Data source: DOST-PAGASA, 2018: *Observed and Projected Climate Change in the Philippines*. Philippine Atmospheric, Geophysical and Astronomical Services Administration, Quezon City, Philippines, 36 pp.

ENSO events greatly influence seasonal and interannual precipitation in the Philippines

The precipitation patterns in the Philippines are influenced by synoptic systems such as monsoons and the El Niño Southern Oscillation (ENSO). ENSO events, specifically El Niño and La Niña, greatly influence seasonal and interannual precipitation in the Philippines. Mature El Niño events often lead to drought and water resource stresses, while La Niña events bring heavy precipitation (“Philippine Climate Change Assessment,” 2016). The impact of ENSO on precipitation varies depending on the interaction between the ENSO life cycle and the seasonal variability of precipitation in specific regions.

Analyzing observational data further supports the influence of ENSO on precipitation patterns. Specifically, during July to September of El Niño years, above-average precipitation occurs over north-central Philippines, preceding the expected below-average conditions in the subsequent October-December period (“Philippine Climate Change Assessment,” 2016). In contrast, during La Niña years, below-average precipitation is observed in July-September over north-central Philippines, followed by wetter than normal conditions in the following October-December period. These findings provide additional insights into the complex relationship between ENSO and precipitation variability in the country (“Philippine Climate Change Assessment,” 2016).



Certain areas more susceptible to precipitation-induced flooding and landslides

Floods in the Philippines commonly occur during monsoon surges and slow-moving tropical cyclones within the Philippine Area of Responsibility (PAR), with the intensity of the monsoon also influenced by La Niña events (“Philippine Climate Change Assessment,” 2016). One notable recent flooding event was caused by Super Typhoon Egay (internationally known as DOKSURI) in July 2023, which unleashed 0.4 to 0.5 meters of rain from its 680-kilometer rainband (Magramo, 2023).

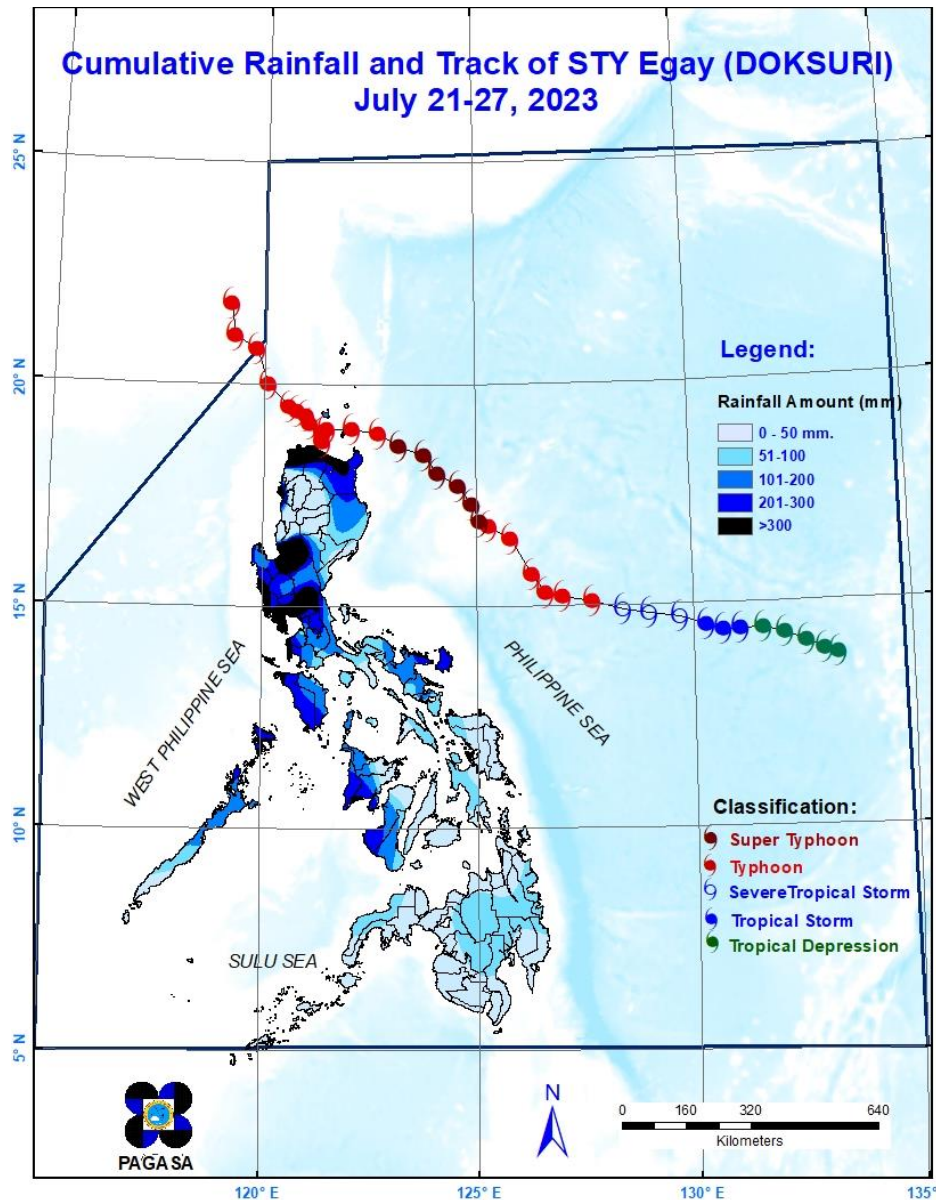


Figure 3.2.3.5: Cumulative rainfall during Super Typhoon Egay (21-27 July, 2023)

Data source: Tropical Cyclone Associated Rainfall. (2023). pagasa.dost.gov.ph.



The Department of Environment and Natural Resources Mines and Geo-Science Bureau (DENR-MGB) in the Philippines conducted a Geo Hazards Mapping and Assessment Program, which resulted in a list of the top ten flood-prone and landslide-prone areas in the country. The selection of these provinces is based on various factors related to their geography and topography.

When it comes to flood-prone areas, several provinces in the Philippines stand out. Pampanga, Nueva Ecija, Tarlac, and Bulacan are among the provinces listed by the DENR-MGB (*Office of the President of the Philippines Malacañang & Climate Change Commission, 2010*). These areas are susceptible to flooding due to their proximity to rivers and bodies of water, as well as other factors such as topography and land characteristics. Metro Manila, being a highly urbanized region, is also included in the list due to its low-lying coastal areas and insufficient drainage systems. Additionally, provinces like Maguindanao, North Cotabato, Oriental Mindoro, and Ilocos Norte have specific geographical features that make them prone to (*Office of the President of the Philippines Malacañang & Climate Change Commission, 2010*).

Landslides typically occur in areas with mountains and high elevation. In the top ten landslide-prone areas identified by the DENR-MGB, all provinces in the Cordillera Administrative Region (CAR) are included. The CAR is situated "on and around the Cordillera Mountain ranges," making the entire region susceptible to landslides after periods of heavy rains, typhoons, or earthquakes (*Office of the President of the Philippines Malacañang & Climate Change Commission, 2010*). Similar conditions exist in other listed provinces such as Southern Leyte, characterized by relatively flat lands where people reside but rugged and mountainous toward the interior (*Office of the President of the Philippines Malacañang & Climate Change Commission, 2010*). The topography of Cebu and Catanduanes is also described as rugged and mountainous (*Office of the President of the Philippines Malacañang & Climate Change Commission, 2010*). Landslides can be triggered by heavy precipitation, earthquakes, volcanic eruptions, as well as human activities like mining and commercial developments (*Office of the President of the Philippines Malacañang & Climate Change Commission, 2010*).

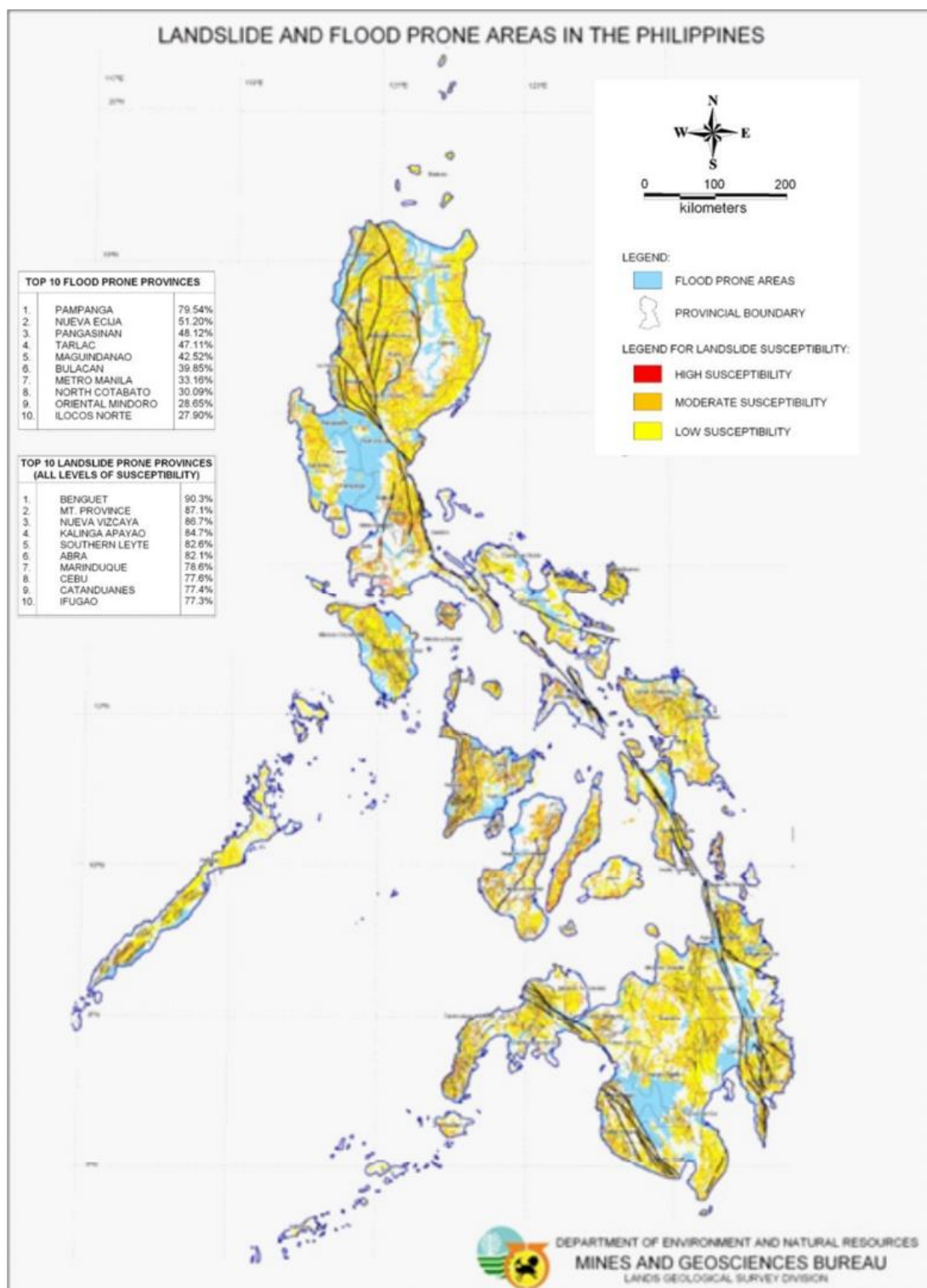


Figure 3.2.3.6: Map of landslides and flood prone areas in the Philippines

Data source: Office of the President of the Philippines Malacañang & Climate Change Commission. (2010). National Framework Strategy on Climate Change 2010-2022.



Impact of extreme precipitation and flooding to the Philippines

The Philippines faces significant challenges when it comes to flooding, with severe cyclones and heavy precipitation contributing to its high exposure ("Climate Risk Country Profile: Philippines," 2021). According to the World Resources Institute's AQUEDUCT Global Flood Analyzer, as of 2010, an estimated 176,000 people are affected by flooding annually in the country, with expected damages reaching \$625 million for events up to a 1 in 25-year magnitude ("Climate Risk Country Profile: Philippines," 2021). The UNISDR reports a slightly lower average annual loss of approximately \$500 million associated with flooding in the Philippines ("Climate Risk Country Profile: Philippines," 2021). Historically, the estimated median number of people in the Philippines affected by an extreme river flood (defined as being in the 90th percentile in terms of numbers of people affected) in the historic period 1971-2004 is 1,943,597 ("Climate Risk Country Profile: Philippines," 2021). These figures are expected to increase due to both development and climate change.

The escalation of flood damage in the Philippines is attributed to a rise in the frequency and intensity of typhoons. The risks posed by flooding are further exacerbated by factors such as land-use changes, including urbanization and logging. The Second National Communication to the UNFCCC acknowledges that while climate change may contribute to the unusual amount of precipitation, the damage and loss of lives caused by floods are often amplified by the clogging of sewers and waterways with waste materials ("Climate Risk Country Profile: Philippines," 2021).

Conclusion

The evidence presented demonstrates the significant impact of climate change on precipitation patterns globally, including in the Philippines. The increase in the frequency and intensity of heavy precipitation events, particularly associated with tropical cyclones, can be attributed to human-induced climate change with high confidence. The observed changes in precipitation patterns, such as the likely increase in global averaged precipitation over land since 1950, further suggest a human influence.

Within Southeast Asia, the Philippines experiences diverse precipitation patterns influenced by monsoons and the El Niño Southern Oscillation (ENSO). The country has seen both increasing and decreasing trends in precipitation across different regions and seasons. Floods, often triggered by monsoon surges and tropical cyclones, pose a significant challenge, exacerbated by factors such as land-use changes and inadequate infrastructure.

The identification of flood-prone and landslide-prone areas in the Philippines through the Geo Hazards Mapping and Assessment Program provides valuable insights into the regions most susceptible to these hazards. Provinces near rivers, with inadequate drainage systems, and mountainous regions are particularly vulnerable.

The findings presented here underscore the urgency of addressing climate change and implementing robust adaptation strategies to manage the shifting precipitation patterns, particularly the increasing frequency of heavy precipitation events and associated flooding.



3.2.4 Extreme wind and tropical cyclone

Extreme wind refers to winds significantly exceeding normal speeds for a given region. Tropical cyclones, also known as hurricanes, typhoons, or cyclones depending on the region, are intense low-pressure systems and can bring destructive winds, storm surges, and torrential precipitation, posing a significant threat to coastal areas and inland regions in their path. Extreme wind events are frequently associated with tropical cyclones, as these systems generate powerful winds capable of causing widespread destruction and impact towards communities, agriculture, and critical infrastructure.

Global trends

Tropical cyclones (TCs) present a threat to human life and livelihoods in tropical coastal regions around the world. Recent studies by the IPCC have provided valuable insights into the historical trends of tropical cyclones (TCs). These investigations have revealed significant findings, including the occurrence of intense TCs making landfall in East and Southeast Asia in recent decades (Collins et al., 2019). Moreover, there has been an observed increase in the proportion of global hurricanes reaching Category 4 or 5 intensity (>118km/h sustained wind speed) over the years (Collins et al., 2019). These findings highlight the importance of studying TCs over extended periods and shed light on the evolving nature of these powerful weather phenomena.

Philippine trends

The Philippines, in particular, is highly exposed to TCs generated in the western North Pacific (WNP) region, with an average of 20.2 TCs entering the Philippines Area of Responsibility (PAR) each year and an annual average of 8.4 tropical cyclones to make landfall in the Philippines (see Figure 3.2.4.1) (PAGASA & DOST, 2023).

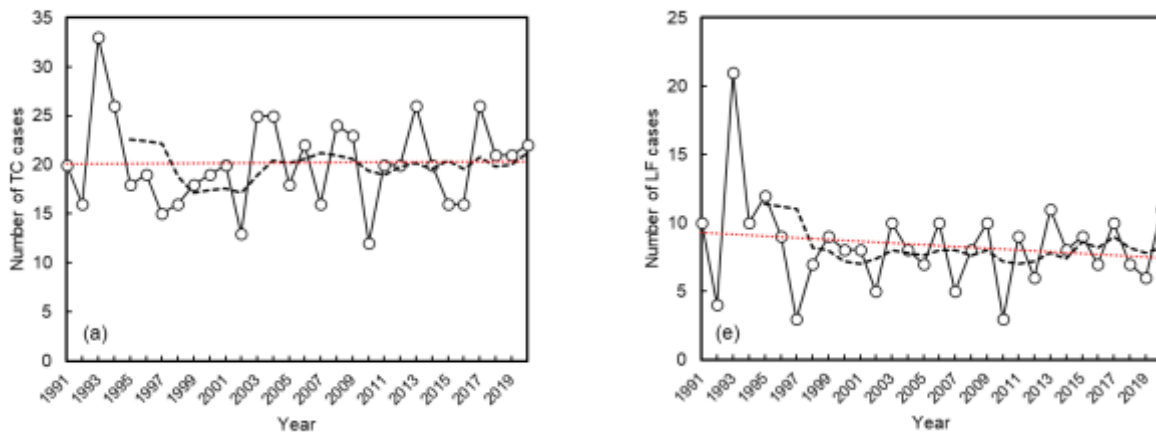


Figure 3.2.4.1: (Left) Total number of TCs that occurred in PAR region from 1991-2019; (Right) Total number of TCs that crossed or made landfall in the Philippines from 1991-2019

Data source: Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) & Department of Science and Technology (DOST). (2023). ANNUAL REPORT ON PHILIPPINE TROPICAL CYCLONES 2020. In pagasa.dost.gov.ph.

Tropical cyclones are systematically classified based on the intensity of their associated winds, following established protocols. In the Philippines, the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) employs a comprehensive categorization system that encompasses five distinct categories. These categories are determined by assessing the 10-minute average wind strengths accompanying the cyclones (see table 3.2.4.1) (PAGASA & DOST, 2023).



Category of TC	Maximum sustained winds near the center			
	Beaufort	kt	km/h	m/s
Tropical Depression (TD)	BF6 to BF7 (Strong winds)	22 to 33	39 to 61	10.8 to 17.1
Tropical Storm (TS)	BF8 to BF9 (Gale-force winds)	34 to 47	62 to 88	17.2 to 24.4
Severe Tropical Storm (STS)	BF10 to BF11 (Storm-force winds)	48 to 63	89 to 117	24.5 to 32.6
Typhoon (TY)	BF12 (Typhoon-force winds)	64 to 99	118 to 184	32.7 to 51.2
Super Typhoon (STY)	BF12 (Typhoon-force winds)	≥ 100	≥ 185	≥ 51.3

Table 3.2.4.1: Categories of TC used by PAGASA

Data source: Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) & Department of Science and Technology (DOST). (2023). ANNUAL REPORT ON PHILIPPINE TROPICAL CYCLONES 2020. In pagasa.dost.gov.ph.

Decreasing frequency of TCs but very strong TCs becoming more frequent

An analysis of tropical cyclone data in the Philippines shows that while there has been a slight decline in the overall number of tropical cyclones, there is an observable upward trajectory in the occurrence of 'Very strong TCs', characterized by maximum sustained wind speeds greater than 170km/h (see Figure 3.2.4.2) (DOST-PAGASA, 2018). Furthermore, the number of typhoons (TY and STY) in the last 30 years have accounted for about half of the total TCs in the nation (see Figure 3.2.4.3) (DOST-PAGASA, 2018). Both these findings underscore the evolving nature of tropical cyclones in the region and necessitate a proactive and adaptive approach to climate resilience, including robust strategies for risk reduction, preparedness, and response to effectively address the intensifying threats posed by these extreme weather events.

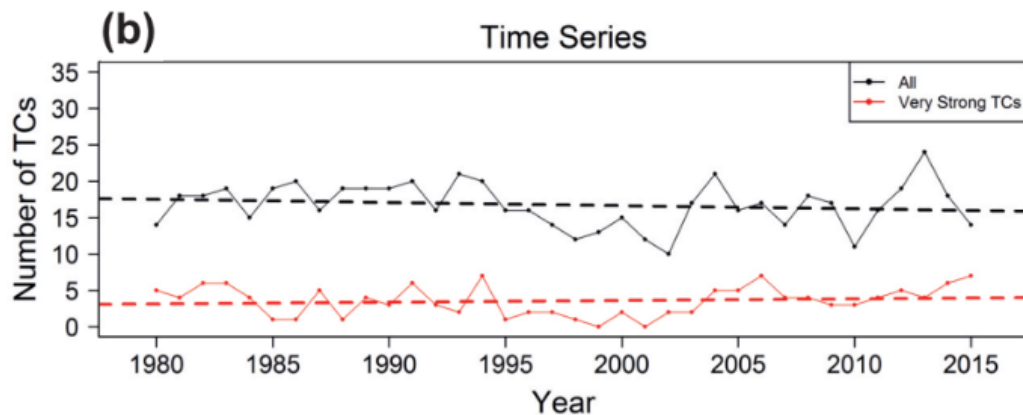


Figure 3.2.4.2: Time series of annual count of all (black line) and very intense tropical cyclones (maximum sustained winds >170kph, red line) that entered the PAR from 1980 to 2015

Data source: OST-PAGASA, 2018: *Observed and Projected Climate Change in the Philippines*. Philippine Atmospheric, Geophysical and Astronomical Services Administration, Quezon City, Philippines, 36 pp.

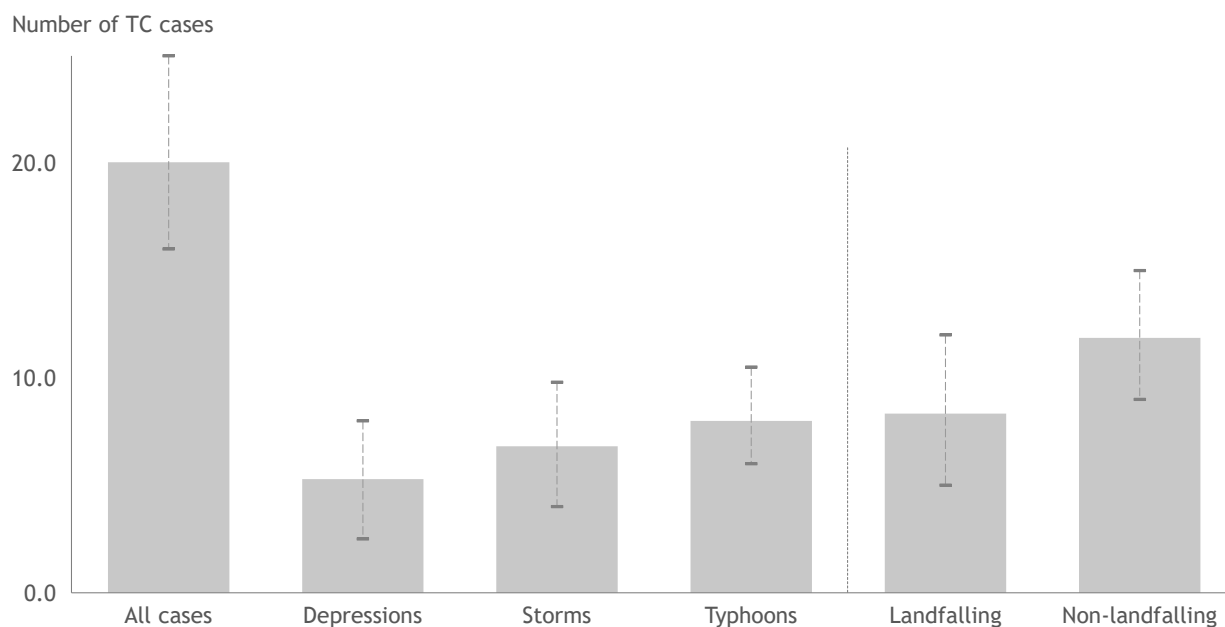


Figure 3.2.4.3: Climatological normal of all TC occurrences within the PAR in the last 30 years, for depressions, storms, and typhoons (both landfalling and non-landfalling TCs) with error bars that represent +1 standard deviation from the climatological normal

Data source: Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) & Department of Science and Technology (DOST). (2023). *ANNUAL REPORT ON PHILIPPINE TROPICAL CYCLONES 2020*.

Pronounced concentration of TCs in the northeastern regions



Furthermore, a spatial analysis was undertaken to discern the geographical areas within the Philippines that were most significantly impacted by tropical cyclones (TCs), as illustrated in Figure 3.2.4.4. The findings revealed a pronounced concentration of TC occurrences in the northeastern region of the country, denoted by the shaded regions in the figure. In contrast, the southwestern part of the country experienced notably fewer TCs, as indicated by the horizontally hatched sections in the same figure (“Philippine Climate Change Assessment,” 2016).

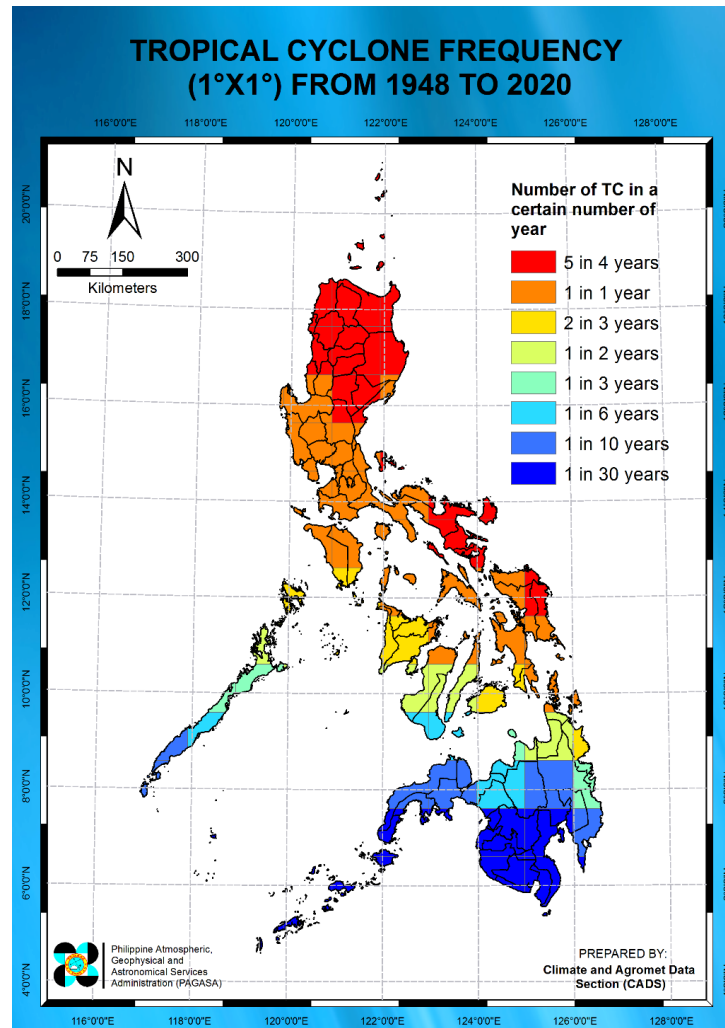


Figure 3.2.4.4: Total number of TCs in the Philippines per $1^{\circ} \times 1^{\circ}$ grid, for the period 1948-2020

Data source: PAGASA (2023)

El Niño-Southern Oscillation (ENSO) affects behavior of TCs

The findings of the spatial analysis and the examination of wind speed data emphasize the pressing need for effective measures to address the long-standing and escalating impact of tropical cyclones on the Philippines. It must also be noted that the frequency of tropical cyclones (TCs) can vary from season to season and year to year, influenced by factors such as the El Niño and La Niña events (“PAGASA,” 2023).



The frequency of tropical cyclones (TCs) can change from season to season and year to year due to factors like El Niño and La Niña events (“PAGASA,” 2023). During El Niño (La Niña) years from July to September, TC activity tends to increase (decrease) due to higher (lower) atmospheric moisture, but this reverses during October to December (“PAGASA,” 2023). Studies also indicate that the genesis location of TCs shifts southeastward (northwestward) during El Niño (La Niña) years, affecting their track, intensity, and lifespan (“PAGASA,” 2023). Moreover, more typhoons hit the northern Philippines in La Niña years compared to El Niño years. These variations in TC behavior during different ENSO phases have significant implications for the affected regions.

Understanding the relationship between ENSO, Pacific Decadal Oscillation (PDO), and TC activity is crucial for anticipating and preparing for the potential impacts of these weather phenomena. By studying these patterns and their effects, scientists and policymakers can enhance their ability to forecast and respond to TC events, ultimately contributing to better disaster preparedness and risk reduction strategies.

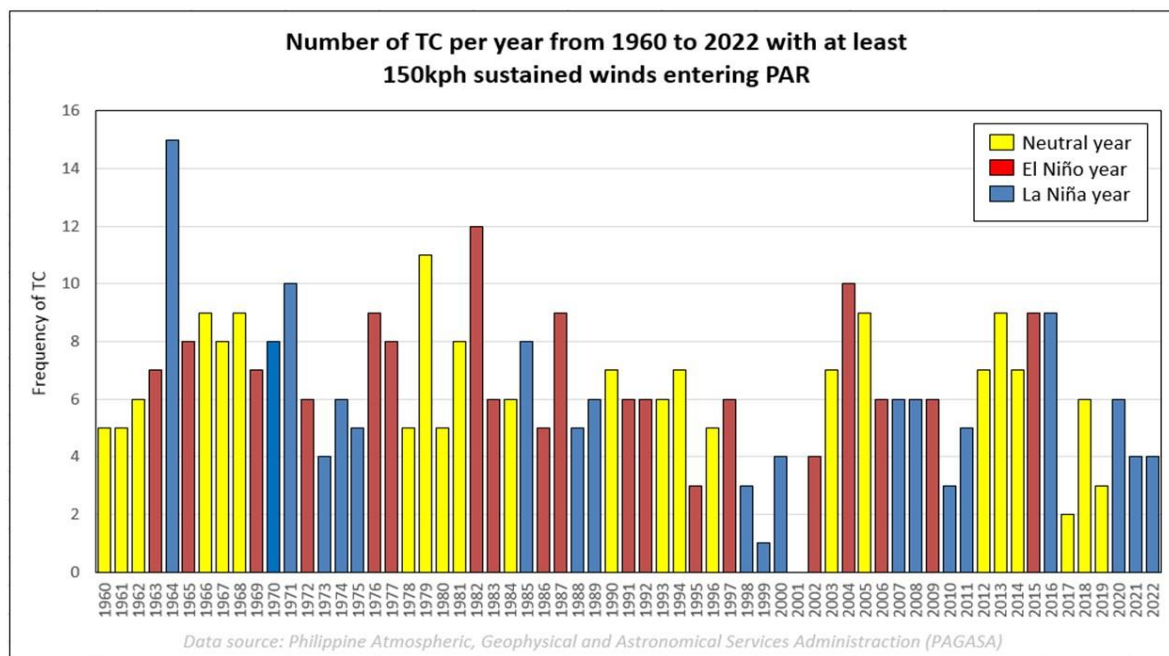


Figure 3.2.4.5: Number of typhoons per year from 1960-2022 with at least 150 kph sustained winds entering the PAR. Years are labeled according to El Niño, La Niña, or neutral conditions. Note that there were no such typhoons in 2001

Data source: PAGASA (2023)

Impact of TCs on the Philippines

Over the past five decades, tropical cyclones (TCs) have inflicted a significant toll on the Philippines, resulting in the loss of 34,435 lives and leaving 75,034 individuals injured since 1970 (PAGASA &



DOST, 2023). These devastating events have underscored the urgent need for effective measures to mitigate their impact and enhance the country's resilience.

It is worth noting that some of the most severe storms in the Philippines have occurred within the past 15 years, marking a worrying trend for a nation accustomed to an average of 20 storms each year. These notable storms include Typhoon Haiyan, Typhoon Ulysses, and Typhoon Egay, to name a few, all of which have garnered international attention.

In the year 2020 alone, the tropical cyclone (TC) season in the Philippines resulted in significant impacts (PAGASA & DOST, 2023) “Philippine Climate Change Assessment,” 2016). Seven notable TCs—Ambo, Ofel, Pepito, Quinta, Rolly, Ulysses, and Vicky—were mostly responsible for a combined total of 733 casualties, including 112 deaths, 610 injuries, and 11 missing individuals (PAGASA & DOST, 2023). Among these, Typhoon Ulysses emerged as the deadliest, claiming the lives of 51 people (PAGASA & DOST, 2023). Furthermore, the economic consequences of the 2020 TC season were substantial. The aggregated cost of damage to agriculture and infrastructure reached PHP 44.222 billion, with infrastructure accounting for the majority (63.6%) of the total cost (PAGASA & DOST, 2023).

It is important to note that the aggregated cost of damage due to TC events has exhibited a steady increase since 1970. This upward trend (see Figure 3.2.4.6) serves as a clear indication of the growing vulnerability of the Philippines to these natural disasters.

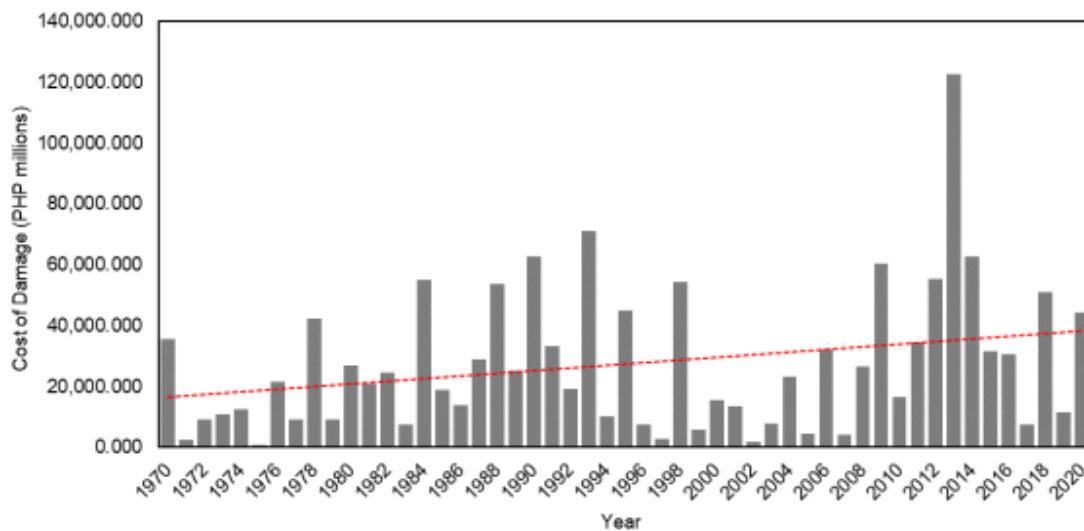


Figure 3.2.4.6: Yearly total cost of damage (in PHP millions) caused by tropical cyclones in the PAR region from 1970 to 2020. The cost values are adjusted to 2020-equivalent values to account for



inflation using the annual average CPIs published by the Philippine Statistics Authority. The red dash line presents the linear trend of the adjusted cost of damage

Data source: Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) & Department of Science and Technology (DOST). (2023). ANNUAL REPORT ON PHILIPPINE TROPICAL CYCLONES 2020. In pagasa.dost.gov.ph.

Conclusion

In conclusion, the Philippines, like many other regions across the globe, is experiencing the impacts of human-induced climate change. The country is particularly vulnerable to extreme weather events, such as tropical cyclones. While there has been a slight decline in the overall number of tropical cyclones, the occurrence of 'very strong TCs' with maximum sustained wind speeds greater than 170km/h has been on the rise. This trend highlights the evolving nature of tropical cyclones in the region and calls for proactive measures to enhance climate resilience.

Spatial analysis has shown that the northeastern part of the Philippines is most significantly impacted by tropical cyclones, emphasizing the need for targeted strategies to mitigate their effects (Cinco, et al.). Furthermore, the frequency and behavior of tropical cyclones can vary due to factors like El Niño and La Niña events, which underscores the importance of understanding these patterns for effective forecasting and disaster preparedness. The Philippines has experienced significant human and economic losses due to tropical cyclones, emphasizing the urgency to address their impact and enhance the country's resilience. The increasing cost of damage over the years serves as a stark reminder of the growing vulnerability of the Philippines to these natural disasters.



3.3 Future climate risks and scenarios

In consultation with the Climate Change Commission (CCC), the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), and national climate experts, the analysis in this section focuses on the SSP2-4.5 and SSP5-8.5 scenarios, and on the decades of 2030 and 2050. These scenarios offer a balanced perspective by encompassing both moderate and high-emission trajectories, allowing for a comprehensive assessment of the country's future climate conditions and preparation to build resilience against the worst impacts of climate change.

The Middle of the Road scenario (SSP2-4.5) reflects moderate challenges to mitigation and adaptation, aligning with historical trends. In this scenario, sustainable development progresses with efforts to reduce GHG emissions and transition towards sustainable practices, albeit with persistent environmental degradation and income inequality. This scenario represents moderate emissions and aims to limit warming to 2°C by 2100, resulting in a projected global average warming of 1.7-3.2°C, as outlined in the current Paris Agreement. It focuses on coordinated action and total radiative forcing stabilization before 2100.

On the other hand, the Fossil-fueled Development scenario (SSP5-8.5) envisions a future where there is limited global effort to mitigate greenhouse gas emissions. It anticipates continued reliance on fossil fuel resources and energy-intensive lifestyles, driving rapid economic growth. This scenario is associated with high emissions, featuring a continuous increase in greenhouse gas emissions over time. Atmospheric Co₂ stabilizes at a substantial level of 30GT, compared to the 8GT recorded in 2000. As a consequence, the projected global average warming under this scenario ranges from 4.2-5.4°C.

It is important to note that the future climate outcomes for the Philippines, as projected under the SSP2-4.5 and SSP5-8.5 scenarios, are subject to uncertainties and depend on various factors such as policy choices, technological advancements, and global cooperation in reducing GHG emissions. Nonetheless, these scenarios provide valuable insights into potential climate futures, enabling stakeholders to consider a range of possibilities and take proactive measures to address climate change challenges in the Philippines.



Anchored on these scenarios and timelines, the "Future Climate Risks and Scenarios" sub-chapter covers **comprehensive projections of Climatic Impact-Drivers (CIDs) and their effects in the coming decades**, built upon three critical layers of analyses.

First, an analysis is conducted on how climate change is projected to evolve at a global level. Second, attention is given to the physical impacts that climate change may bring to the Philippines. Lastly, the translation of these physical impacts into socio-economic metrics is carried out to understand potential effects on the Philippine population and economy.

The analysis in this chapter focuses on four specific climatic impact-drivers – increased temperature and droughts, sea level rise and extreme sea levels, extreme precipitation, and intense wind and tropical cyclones, which have caused, and are projected to continue causing a vast majority of impact to the Philippines in the coming decades. It also assumes that no actions are taken to curb damages brought upon the nation by these climatic impact-drivers, projecting the potential impacts across physical, social, and economic domains. A summary of projected estimates and ranges of these are highlighted in the following tables and write-ups.



Physical Impact	Impact across 2030 decade (2030-2040 average)	Impact across 2050 decade (2050-2060 average)
Temperature rise may place PH in "Danger" heat index category	Average heat index of 38.9°C (+5% vs 1991-2020 averages)	Average heat index of 41.2°C (+11% vs 1991-2020 averages)
PH sea levels may rise ⁴⁹ >2x faster in 2050 than current global average	Seas rising by +6.6 mm/year, causing ~0.25m increase	Seas rising by +8.9 mm/year, causing ~0.5m increase
Precipitation projected to become more erratic regionally	Precipitation levels projected to increase in Eastern areas in mid-section of the country (historically climate type II⁵⁰) and central and eastern areas of Luzon (historically climate types I, III, and IV), and decrease in Northeastern portions of Luzon and southern areas of Mindanao (historically encompassing areas climate type III or IV)	
Tropical cyclones projected to intensify by almost a third ⁵¹	+29% average max tropical cyclone wind speed	+33% average max tropical cyclone wind speed

Table 3.3.1. Estimated range of CID-driven physical impacts in the Philippines, SSP5-8.5

From a physical perspective, the average heat index across the nation is projected to increase to up to 38.9°C in 2030 and 41.2°C in 2050. Sea-level rise is projected to increase at a rate of 6.6 mm/year across the 2030 decade, exceeding the global average, before possibly increasing to 8.9 mm/year by 2050. This rate of sea level rise is projected to result in sea levels up to 0.25m and 0.5m higher than the average across the years 1995-2014, as well as extreme sea levels reaching 3m between 2030-40 and 2050-60 across a 10-year return period. Rainfall patterns are projected to become more extreme, causing more frequent, intensified precipitation throughout the year, especially in the eastern sections of the country. Lastly, while the frequency of typhoons entering the Philippine Area of Responsibility may decrease, intensity is projected to significantly increase, with the average maximum wind speed of typhoons and super typhoons increasing by 29% by 2030 and 33% by 2050.

⁴⁹ Compared with 1995-2014 average sea levels

⁵⁰ Climate types based on Modified Coronas Classification System: Type I – Two pronounced seasons: Dry from November to April, wet during the rest of the year; Type II – No dry season with a very pronounced rainfall from November to April and wet during the rest of the year; Type III – Seasons are not very pronounced; relatively dry from November to April, wet during the rest of the year; Type IV – Rainfall is more or less evenly distributed through the year

⁵¹ Compared with 2010-2020 historical average



Social Impact	Impact across 2030 decade (2030-2040 annualized average)	Impact across 2050 decade (2050-2060 annualized average)
Dangerous temperature exposure to 50%+ of the PH population in 2050	• ~11M exposed to “Dangerous” heat index levels⁵²	• ~74M exposed to “Dangerous” heat index levels⁵³
Rising sea levels projected to impact 2M+ Filipinos per year	• ~150k permanently displaced by sea level rise • ~1.9M exposed to extreme sea levels	• ~420k permanently displaced by sea level rise • ~2M exposed to extreme sea levels
Extreme precipitation ⁵⁴ may expose 5M+ Filipinos to floods and landslide annually	• ~4.8M exposed to pluvial flooding • ~250k exposed to fluvial flooding • ~200k exposed to landslides	• ~5.2M exposed to pluvial flooding • ~300k exposed to fluvial flooding • ~200k exposed to landslides
Severe tropical cyclones ⁵⁵ projected to impact 5-6M Filipinos per year	• ~5.3M exposed to a typhoon and/or super typhoon	• ~6M exposed to a typhoon and/or super typhoon

Table 3.3.2. Estimated range of CID-driven social impacts in the Philippines, SSP5-8.5

From a social perspective, 11 million Filipinos are projected to be exposed to heat indices above 42 degrees, at which point heat cramps, exhaustion and heat stroke are probable with continued exposure – this number is expected to increase to up to 74 million Filipinos in 2050. Sea level rise may permanently displace 150,000 and 420,000 Filipinos in 2030 and 2050, respectively – extreme sea levels, whose heights are projected to intensify as sea levels rise, may impact 1.9 million Filipinos in 2030, increasing to 2 million in 2050. Extreme precipitation causes pluvial and fluvial floods, as well as landslides – 4.8 million Filipinos may be affected by pluvial flooding and an additional 250,000 impacted by fluvial flooding in 2030, growing to 5.2 million and 300,000 in 2050, with rain-induced landslides potentially impacting up to 200,000 Filipinos annually throughout this period. Lastly,

⁵² Category of heat indices greater than 42°C, where heat cramps, exhaustion and heat stroke are probable with continued exposure

⁵³ Category of heat indices greater than 42°C, where heat cramps, exhaustion and heat stroke are probable with continued exposure

⁵⁴ Impact averaged between 2020-40, 2040-60 for social impacts driven by extreme precipitation

⁵⁵ Typhoon: > 118 km/h & < 184 km/h; Super Typhoons: > 185 km/h



approximately 5.3 million Filipinos may face more than one typhoon and/or super typhoon in 2030, climbing to 6 million in 2050.

From an economic perspective, severe impacts are projected from these climatic impact-drivers, with potential economic losses equating to damages of roughly 7.6% and 13.6% of GDP in 2030 and 2040⁵⁶, and potentially increasing to 18-25% of GDP by 2050^{57,58,59}. Of this, costs occurring from infrastructure damage, productivity loss due to extreme heat, and relocation of populations are projected to sum up to PHP 0.8Tn in 2030 and PHP 1.3Tn in 2050. The range of projected cost of inaction and its components in 2030, SSP5-8.5 is visualized in Figure 3.3.1 below.

Projected cost of inaction across the Philippines in 2030

PHP Billion (% of 2020 GDP)

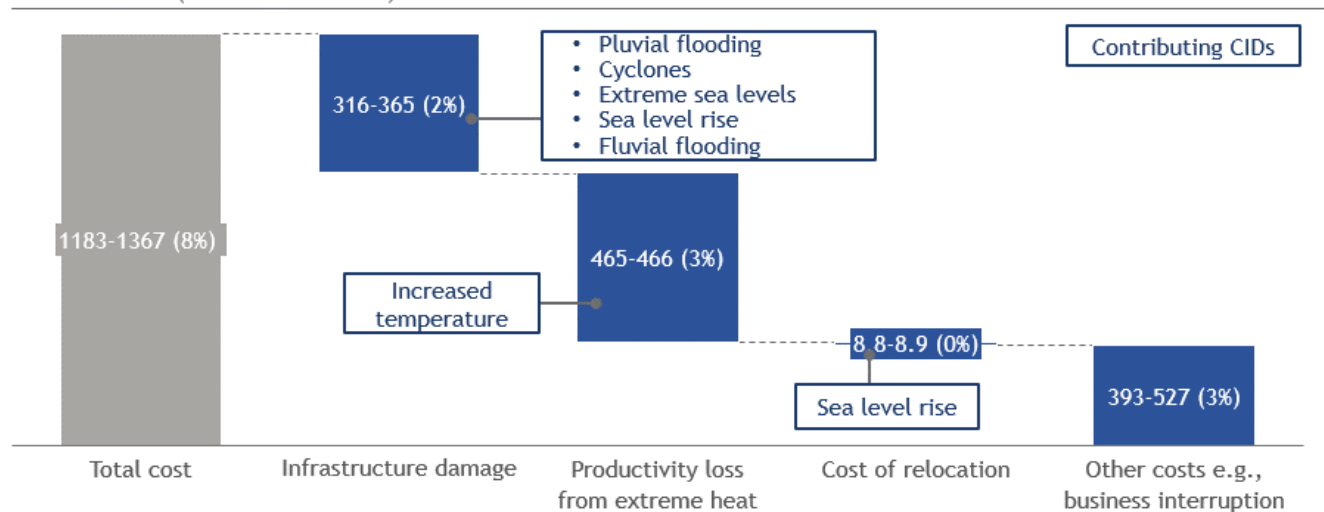


Figure 3.3.1. Range of possible cost of inaction, and contributing CIDs in 2030, SSP5-8.5

From a climatic impact-driver perspective, productivity loss from extreme heat is a significant driver of cost, projected to reach up to PHP 466Bn annually by 2030 and soar to PHP 870Bn annually by 2050. Annual losses arising from sea level rise and extreme sea levels, stemming from impacts such as damage of infrastructure or relocation of populations, are projected to hit PHP 98Bn and PHP 129Bn in 2030 and 2050, respectively. Due to extreme precipitation, pluvial and fluvial floods are projected to cause annual economic losses of PHP 287Bn in 2030, and PHP 312Bn in 2050. Lastly,

⁵⁶ The World Bank Group. (2022). Philippines Country Climate and Development Report

⁵⁷ Swiss Re Institute. (2021). The economics of climate change: no action not an option

⁵⁸ Andrijevic, M., Ware, J. (2021). Lost & Damaged: A study of the economic impact of climate change on vulnerable countries.

⁵⁹ Given the wide range of possible outcomes, this range of values was chosen as a rough indication of total impacts the Philippines may face in 2050.



infrastructure damaged by intense wind and tropical cyclones may generate annual damages of PHP 83Bn and PHP 78Bn in 2030 and 2050.

Further detailed analyses on global and Philippine-specific trends for each CID can be found in the following sub-sections in this chapter.



3.3.1 Increased temperature and drought

Future global trends

Key takeaways

- For every additional 0.5°C of global warming, extreme weather events intensify and occur more frequently, including heatwaves, droughts (both meteorological and hydrological), with more regions experiencing increases than decreases (IPCC, 2021).
- Temperatures are projected to be 1.2°C to 1.8°C (SSP2-4.5) and 1.3°C to 1.9°C (SSP5-8.5) higher in 2030 and 1.6°C to 2.5°C (SSP2-4.5) and 1.9°C to 3.0°C (SSP5-8.5) higher in 2050 compared to 1850-1900 figures (IPCC, 2021).

Multiple studies suggest that global surface temperature will continue to rise until at least mid-century in all emissions scenarios. In the near term, including the year 2030, temperatures are projected to be 1.2°C to 1.8°C (SSP2-4.5) and 1.3°C to 1.9°C (SSP5-8.5) higher compared to 1850-1900 figures (IPCC, 2021). In the mid-term, including the year 2050, temperatures are projected to increase by 1.6°C to 2.5°C (SSP2-4.5) and 1.9°C to 3.0°C (SSP5-8.5) compared to 1850-1900 (see Figures 3.3.1.1 and 3.3.1.2) (IPCC, 2021).

Scenario	Near term, 2021–2040		Mid-term, 2041–2060		Long term, 2081–2100	
	Best estimate (°C)	Very likely range (°C)	Best estimate (°C)	Very likely range (°C)	Best estimate (°C)	Very likely range (°C)
SSP1-1.9	1.5	1.2 to 1.7	1.6	1.2 to 2.0	1.4	1.0 to 1.8
SSP1-2.6	1.5	1.2 to 1.8	1.7	1.3 to 2.2	1.8	1.3 to 2.4
SSP2-4.5	1.5	1.2 to 1.8	2.0	1.6 to 2.5	2.7	2.1 to 3.5
SSP3-7.0	1.5	1.2 to 1.8	2.1	1.7 to 2.6	3.6	2.8 to 4.6
SSP5-8.5	1.6	1.3 to 1.9	2.4	1.9 to 3.0	4.4	3.3 to 5.7

Figure 3.3.1.1: Near-, mid-, and long-term changes in global surface temperature relative to 1850-1900

Data source: Intergovernmental Panel on Climate Change Sixth Assessment Report Summary for Policy Makers (2021) Figure SPM.1 p.14

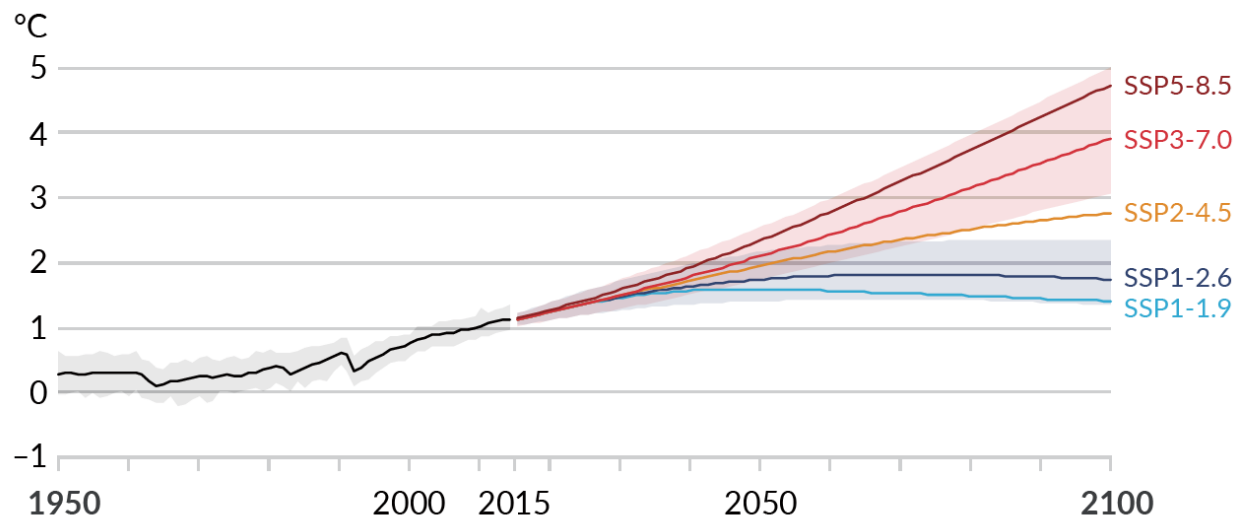


Figure 3.3.1.2: Annual changes in global surface temperature relative to 1850-1900

Data source: Intergovernmental Panel on Climate Change Sixth Assessment Report Summary for Policy Makers (2021) Figure SPM.8 p.22

With each incremental rise in global warming, the effects on extreme weather events become more pronounced. An increase of 0.5°C leads to noticeable intensification and frequency of hot extremes, such as heatwaves, as well as agricultural and ecological droughts in certain regions (IPCC, 2021). Meteorological droughts show discernible changes in intensity and frequency, with more regions experiencing increases than decreases, for every additional 0.5°C of global warming (IPCC, 2021). In some regions, the frequency and intensity of hydrological droughts also escalate with rising global temperatures.

Potential Philippines trends

Key takeaways

- Average nationwide temperature is projected to increase up to 0.9°C in the near term (2021-2040 annualized average) and up to 1.7°C in the longer term (2041-2060 annualized average) compared to 1991-2020 (Boston Consulting Group, 2023).
- By 2050 decade, the national average heat index, which accounts for the combined effects of temperature and humidity and reflects the impact on the human body, is projected to increase by up to 4.2°C, reaching up to 41.2°C and placing the country very near the 'Danger' heat index category (Boston Consulting Group, 2023).
- The average number of consecutive dry days is projected to see a slight increase from 22 days per year to 22-24 days during the 2030-2040 period and 23-25 days in the 2050-2060 timeframe (Boston Consulting Group, 2023). Prolonged periods of dry days can have consequences on agriculture, water supply, and the overall economy.



- The average number of unproductive days⁶⁰ due to extreme heat is projected to escalate from the current level of 28 days annually to 64-77 days by 2030 and reach a range of 133-168 days by 2050 (Boston Consulting Group, 2023).

Average temperature projected to increase up to 0.9°C by 2030 and up to 1.7°C by 2050 compared to 1991-2020

Average temperature (°C) is projected to increase across the Philippines. In the near term, (2021-2040 annualized average), nationwide average temperature is projected to increase by approximately 0.8°C (SSP2-4.5) to 0.9°C (SSP5-8.5), resulting in an absolute average nationwide temperature of 26.7°C to 26.8°C compared to 25.8°C baseline average from 1991-2020⁶¹ (Boston Consulting Group, 2023). In the longer term (2041-2060 annualized average), nationwide average temperature by 2050 is projected to further increase to 27.4°C under SSP2-4.5 scenario and 27.6°C under SSP5-8.5 scenario, which is a 1.5°C to 1.7°C increase from the baseline years of 1991-2020 (see Table 3.3.1.1) (Boston Consulting Group, 2023).

Region	1991-2020 (baseline)	2021-2040 annualized average		2041-2060 annualized average	
		SSP2-4.5	SSP5-8.5	SSP2-4.5	SSP5-8.5
Nationwide average temperature (°C)	25.8	26.7	26.8	27.4	27.6
Nationwide average projected temperature increase (°C)		0.8	0.9	1.5	1.7

Table 3.3.1.1⁶²: Nationwide average temperature, temperature increase by 2030 and 2050 decades under SSP2-4.5 and SSP5-8.5 scenarios

Note: The methodology employs 30-year baselines for historical variability when possible. In cases with only a decade of data available, 10-year baselines are used, maintaining forecast consistency with 10-year ranges.

Data source: Boston Consulting Group. (2023). Data Model on Extreme Heat and Droughts [Data model]. Retrieved from CMIP6 (Coupled Model Intercomparison Project Phase 6) database.

⁶⁰ Unproductive days is characterized by heat index temperatures exceeding 42°C.

⁶¹ Baseline of 2010-2020 used due to data limitations on socio-economic modelling

⁶² Methodology provided in appendix.



Average heat index⁶³ projected to increase up to 1.7°C by 2030 and up to 4.2°C by 2050 compared to 2010-2020

The country's heat index is anticipated to undergo a significant increase in the coming decades. Projections indicate that by the 2030 decade, the national average heat index will increase from 37°C to 38.4°C to 38.9°C, remaining within the 'Extreme Caution' heat index group (Boston Consulting Group, 2023). However, by the 2050 decade, the heat index is projected to near 'Danger' zone, with temperatures ranging from 40.3°C to 41.2°C (see Table 3.3.1.2).

Average number of consecutive dry days projected to slightly increase

The projected increase in the average number of consecutive dry days⁶⁴ from 22 days per year to 22-24 days in the 2030-2040 period and 23-25 days in the 2050-2060 period, has implications for drought conditions, indicating a potential impact on water resources and agricultural activities (see Table 3.3.1.2) (Boston Consulting Group, 2023).

Region	2010-2020 (baseline)	2030 decade (2030-2040 annualized average)		2050 decade (2050-2060 annualized average)	
		SSP2-4.5	SSP5-8.5	SSP2-4.5	SSP5-8.5
Nationwide average heat index (°C)	37.0	38.4	38.9	40.3	41.2
Nationwide average consecutive dry days	22	24	22	25	23

Table 3.3.1.2⁶⁵: Nationwide average heat index and consecutive dry days by 2030 and 2050 decades under SSP2-4.5 and SSP5-8.5 scenarios

⁶³ The heat index is a measure that considers both air temperature and relative humidity to determine the level of discomfort or danger due to heat. The heat index categories used for classification (based on PAGASA classification) is as follows:

- Caution: Heat index ranging from 27-32°C
- Extreme caution: Heat index ranging from 33-41°C
- Danger: Heat index ranging from 42-51°C
- Extreme danger: Heat index of 52°C and above

⁶⁴ Consecutive Dry Days: Maximum number of consecutive days with precipitation below 1 mm in a year

⁶⁵ Methodology provided in appendix.



Note: The methodology employs 30-year baselines for historical variability when possible. In cases with only a decade of data available, 10-year baselines are used, maintaining forecast consistency with 10-year ranges.

Data source: Boston Consulting Group. (2023). Data Model on Extreme Heat and Droughts [Data model]. Retrieved from CMIP6 (Coupled Model Intercomparison Project Phase 6) database.

The number of unproductive days in a year due to extreme heat will soar⁶⁶

The number of unproductive days, characterized by days with heat index temperatures exceeding 42°C, is projected to rise significantly. Currently averaging 28 days per year (2010-2020), unproductive days may increase up to 64 to 77 days by the 2030 decade and further to 133 to 168 days by the 2050 decade (Boston Consulting Group, 2023). Moreover, the maximum number of unproductive days nationwide is projected to surge from the current level of 148 days to 254 to 274 days by the 2030 decade and 337 to 344 days by the 2050 decade (Boston Consulting Group, 2023).

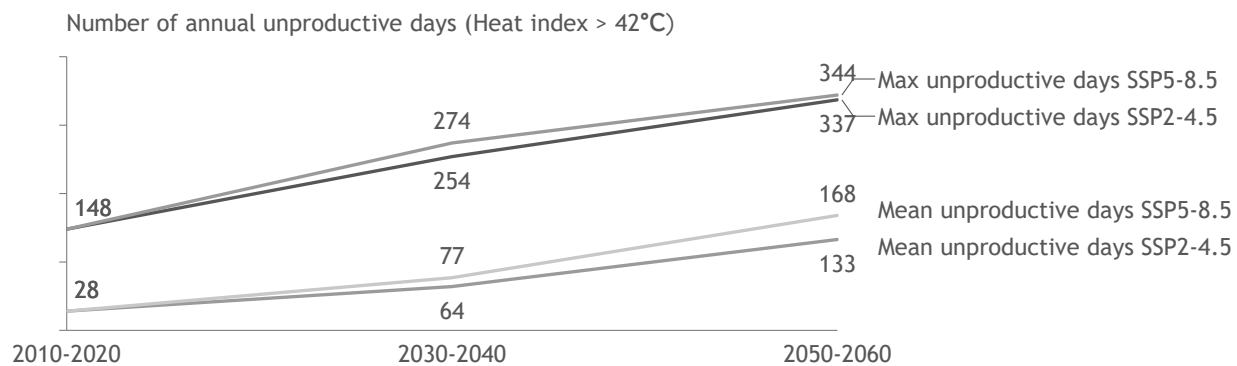


Figure 3.3.1.3: Mean and maximum number of annual unproductive days by 2030 and 2050 decades under SSP2-4.5 and SSP5-8.5 scenarios

Note: The methodology employs 30-year baselines for historical variability when possible. In cases with only a decade of data available, 10-year baselines are used, maintaining forecast consistency with 10-year ranges.

Data source: Boston Consulting Group. (2023). Data Model on Extreme Heat and Droughts [Data model]. Retrieved from CMIP6 (Coupled Model Intercomparison Project Phase 6) database.

⁶⁶ Methodology provided in appendix.



Potential socio-economic impact

Key takeaways

- By 2030, up to 11 million Filipinos are projected to be exposed to heat indices greater than 42°C, with this number expected to increase to up to 74 million by 2050 (Boston Consulting Group, 2023).
- Labor productivity loss or reduced work capacity due to heat stress is projected to reach up to PHP 466 Bn by 2030 and a staggering PHP 870 Bn by 2050 (Boston Consulting Group, 2023).

Socioeconomic Impact	2030 decade (2030-2040 annualized average)		2050 decade (2050-2060 annualized average)	
	SSP2-4.5	SSP5-8.5	SSP2-4.5	SSP5-8.5
Social impact: Population exposed	4 Mn	11 Mn	73 Mn	74 Mn
Economic Impact: Labor productivity loss (PHP)	465 Bn	466 Bn	645 Bn	870 Bn

Table 3.3.1.3: Social and economic impact of increased temperature

Note: Figures provided are approximations; Population exposed to extreme heat defined as population located in area exposed to heat index with a yearly average greater than 42°C; Labor productivity lost due to extreme heat defined as reduced work capacity arising from slower work, or a complete suspension of work, as a result of heat stress

Data source: Boston Consulting Group. (2023). Data Model on Extreme Heat and Droughts [Data model]. Retrieved from CMIP6 (Coupled Model Intercomparison Project Phase 6) database.

Up to 74 million Filipinos and PHP 870 Bn on the line by 2050⁶⁷ due to extreme heat

The potential impact of extreme heat on Filipinos is a growing concern. By 2030, up to 11 million people could be affected by heat indices exceeding 42°C. This number could potentially skyrocket to 74 million by 2050, particularly under the SSP5-8.5 scenario (Boston Consulting Group, 2023). This increase is largely driven by a nationwide average heat index that could reach 41.2°C by 2050 under SSP5-8.5, affecting a larger portion of the population. Furthermore, the economic consequences of

⁶⁷ Methodology provided in appendix.



reduced work capacity due to heat stress are substantial, with potential losses ranging from PHP 465-466 billion by 2030 to PHP 645-870 billion by 2050 (Boston Consulting Group, 2023).

Most impacted regions

Key takeaways

- Mindanao is projected to be most impacted by temperature increase overall, experiencing:
 - The highest increase in average temperature -- up to 1.1°C (+4%) in the near term (2021-2040 annualized average) and 2.0°C (+8%) in the long term (2041-2060 annualized average) versus 1991-2020 (Boston Consulting Group, 2023).
 - Unproductive days may reach as high as 274 days in 2030 and 344 days in 2050 in some areas in Mindanao under SSP5-8.5 (Boston Consulting Group, 2023).
- Both Visayas and Mindanao are projected to experience an increasing number of consecutive dry days. Visayas with up to +58% by 2030 (from 15 to 24 days) and +54% by 2050 (from 15 to 23 days) and Mindanao with up to +39% by 2030 (from 14 to 19 days) and +44% (from 14 to 20 days) by 2050 compared to 2010-2020 (Boston Consulting Group, 2023).
- On a regional level, NCR and CAR in Luzon and Region XIII (Caraga Region) in Mindanao are projected to have the highest temperature increases in the near term, reaching up to 6.3% (NCR), 6.2% (CAR), and 6.1% increase compared to 1991-2020 baseline (Region XIII) (Boston Consulting Group, 2023).
- Regions IX (Zamboanga) in Mindanao, VIII (Eastern Visayas), and VI (Western Visayas) are projected to hold 63% (~7Mn of ~11Mn) of total Filipinos impacted by extreme heat, or heat indices greater than 42°C by 2030 under SSP5-8.5 scenario (Boston Consulting Group, 2023).
- Regions IV-A (Calabarzon), III (Central Luzon), and NCR in Luzon face 36% (around PHP ~167 Bn out of PHP ~466 Bn) of Philippines' Labor Productivity Loss Due to Extreme Heat by 2030 under SSP5-8.5

Mindanao projected to experience highest increase in average temperature and have areas with the highest number of unproductive days

It is crucial to emphasize the spatial variability in temperature changes throughout the country, as different regions will encounter more pronounced shifts compared to the 1991-2020 average. Notably, the southern region of the country, Mindanao, is projected to experience the most substantial increase in average temperature by both 2021-2040 and 2041-2060 (see Table 3.3.1.4) (Boston Consulting Group, 2023). Consequently, Mindanao is also projected to have certain areas with the highest number of maximum unproductive days in the country during the 2030 and 2050 decades (see Table 3.3.1.5) and a substantial increasing percent change of average number of consecutive dry days by 2030 and 2050 versus 2010-2020 (see Table 3.3.1.6) (Boston Consulting Group, 2023).



Island Group	2021-2040		2041-2060	
	Average temperature change versus 1991-2020		Average temperature change versus 1991-2020	
	SSP2-4.5	SSP5-8.5	SSP2-4.5	SSP5-8.5
Luzon	0.7°C (+3%)	0.8°C (+3%)	1.4°C (+6%)	1.6°C (+7%)
Visayas	0.8°C (+3%)	0.9°C (+3%)	1.5°C (+6%)	1.7°C (+6%)
Mindanao	1.1°C (+4%)	1.1°C (+4%)	1.7°C (+7%)	2°C (+8%)
Nationwide	0.8°C (+3%)	0.9°C (+4%)	1.5°C (6%)	1.7°C (+7%)

Table 3.3.1.4: Average temperature change (%) versus historical baseline (1991-2020) by island group in years 2021-2040 and 2041-2060 under SSP2-4.5 and SSP5-8.5 scenarios

Note: The methodology employs 30-year baselines for historical variability when possible. In cases with only a decade of data available, 10-year baselines are used, maintaining forecast consistency with 10-year ranges.

Data source: Boston Consulting Group. (2023). Data Model on Extreme Heat and Droughts [Data model]. Retrieved from CMIP6 (Coupled Model Intercomparison Project Phase 6) database.

Island Group	2010-2020 Maximum unproductive days	2030-2040		2050-2060	
		Maximum unproductive days		Maximum unproductive days	
		SSP2-4.5	SSP5-8.5	SSP2-4.5	SSP5-8.5
Luzon	137	190 (+39%)	208 (+52%)	250 (+82%)	259 (+89%)
Visayas	143	199 (+39%)	229 (+60%)	264 (+85%)	280 (+89%)
Mindanao	148	254 (+72%)	274 (+85%)	337 (+128%)	344 (+132%)
Nationwide	148	254 (+72%)	274 (+85%)	337 (+128%)	344 (+132%)

Table 3.3.1.5: Maximum number of unproductive days by island group in 2010, 2030, and 2050 decades under SSP2-4.5 and SSP5-8.5 scenarios; Unproductive days defined as days with heat index temperatures exceeding 42°C

Note: The methodology employs 30-year baselines for historical variability when possible. In cases with only a decade of data available, 10-year baselines are used, maintaining forecast consistency with 10-year ranges.



Data source: Boston Consulting Group. (2023). Data Model on Extreme Heat and Droughts [Data model]. Retrieved from CMIP6 (Coupled Model Intercomparison Project Phase 6) database.

Island Group	2010-2020 Average number of consecutive dry days	2030-2040		2050-2060	
		Average number of consecutive dry days (% change versus 2010 to 2020 figures)		Average number of consecutive dry days (% change versus 2010 to 2020 figures)	
		SSP2-4.5 ⁸	SSP5-8.5	SSP2-4.5	SSP5-8.5
Luzon	27	27 (+2%)	27 (0%)	30 (+13%)	29 (+7%)
Visayas	15	24 (+58%)	21 (+41%)	23 (+54%)	21 (+37%)
Mindanao	14	19 (+39%)	16 (+22%)	20 (+44%)	17 (+28%)
Nationwide	20	24 (+19%)	23 (+12%)	26 (+26%)	23 (+16%)

Table 3.3.1.6: Number and percent change (versus 2010-2020 historical baseline) of consecutive dry days island group in 2030 and 2050 decades under SSP2-4.5 and SSP5-8.5 scenarios; Consecutive Dry Days (CDD): Maximum number of consecutive days with precipitation below 1 mm in a year. If a dry spell extends beyond one year, the accumulated dry days are carried forward until the spell ends.

Note: The methodology employs 30-year baselines for historical variability when possible. In cases with only a decade of data available, 10-year baselines are used, maintaining forecast consistency with 10-year ranges.

Data source: Boston Consulting Group. (2023). Data Model on Extreme Heat and Droughts [Data model]. Retrieved from CMIP6 (Coupled Model Intercomparison Project Phase 6) database.

NCR, CAR, and Region XIII (Caraga Region) are projected to have the highest temperature increases by 2030

By 2030 (2021-2040 average), the temperature in NCR and CAR in Luzon are projected to rise by 6.3% and 6.2% respectively compared to 1991-2020 averages, while Region XIII (Caraga Region) in Mindanao will see an increase of 6.1% under the SSP5-8.5 scenario (Boston Consulting Group, 2023). These regions stand out as hotspots for temperature changes, warranting special attention and adaptation measures to mitigate the potential impacts associated with rising temperatures.



Regions IX (Zamboanga), VIII (Eastern Visayas), and VI (Western Visayas) are projected to hold 63% (~7Mn of ~11Mn) of total Filipinos impacted by extreme heat by 2030

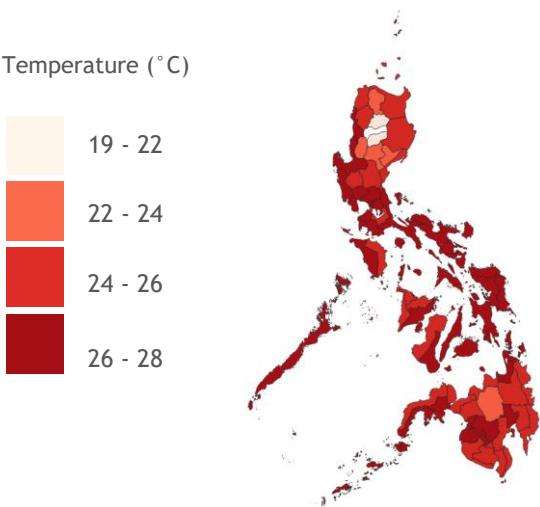
Regions IX (Zamboanga), VIII (Eastern Visayas), and VI (Western Visayas) are projected to have about 2.7 Mn, 2.1 Mn, and 1.8 Mn (total of ~7Mn) people impacted by extreme heat, or heat indices greater than 42°C by 2030 under SSP5-8.5 scenario (Boston Consulting Group, 2023).

Regions IV-A (Calabarzon), III (Central Luzon), and NCR face 36% of Philippines' Labor Productivity Loss Due to Extreme Heat by 2030

In terms of economic impact, as measured by labor productivity loss due to extreme heat (defined as reduced work capacity resulting from slower work or complete work suspension due to heat stress), specific regions stand out. Regions IV-A (Calabarzon), III (Central Luzon), and NCR (National Capital Region) collectively account for a significant portion of the Philippines' labor productivity loss due to extreme heat by 2030. Specifically, these three regions are projected to contribute approximately 36% (around PHP ~167 Bn out of PHP ~466 Bn) of the total economic impact resulting from reduced work capacity due to heat stress in the country, as per the SSP5-8.5 scenario (Boston Consulting Group, 2023).



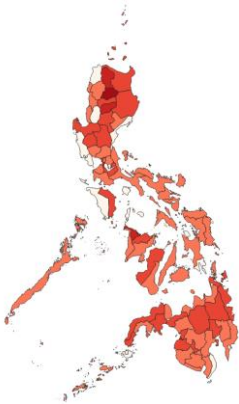
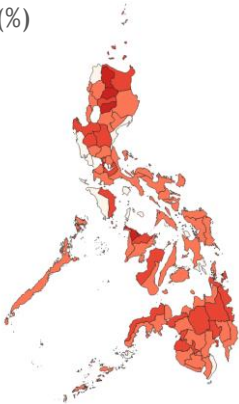
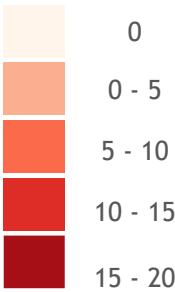
Baseline: 1991-2020



2021-2040 (SSP2-4.5)

2021-2040 (SSP5-8.5)

Temperature increase (%)



2041-2060 (SSP2-4.5)

2041-2060 (SSP5-8.5)

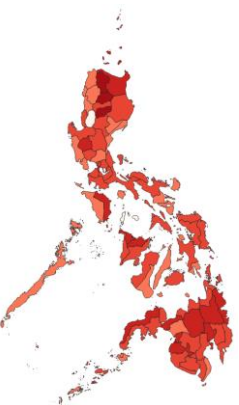
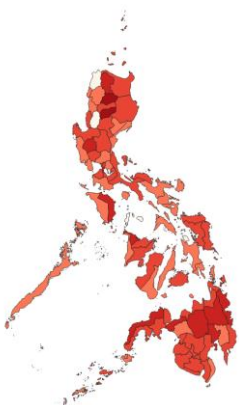




Figure 3.3.1.4: 1991-2020 Historical annualized average temperature and average annualized temperature increase (%) under SSP2-4.5 and SSP5-8.5 scenario by 2021-2040 and 2041-2060

Note: The methodology employs 30-year baselines for historical variability when possible. In cases with only a decade of data available, 10-year baselines are used, maintaining forecast consistency with 10-year ranges.

Data source: Boston Consulting Group. (2023). Data Model on Extreme Heat and Droughts [Data model]. Retrieved from CMIP6 (Coupled Model Intercomparison Project Phase 6) database.



Region	Temperature change (%)	Temperature change (°C)	1991-2020 average temperature (°C)	2021-2040 average temperature (°C)	Pop. Impacted (k people) by 2030	% of total population impacted (2020 population)	Economic impact (Bn PHP) by 2030
National Capital Region	6.3	1.7	26.9	28.6	-	-	45
Cordillera Administrative Region	6.2	1.3	21.9	23.3	-	-	3
Region XIII	6.1	1.6	26.1	27.7	740	26%	14
Region VI	5.9	1.5	26.1	27.6	1,820	23%	38
Region XII	5.8	1.5	25.6	27.1	-	-	23
Region X	5.1	1.3	25.2	26.4	570	11%	24
Region II	4.3	1	24.4	25.5	-	-	10
Region IX	4.2	1.1	26.4	27.5	2,680	69%	30
Region XI	3.6	0.9	25.6	26.5	620	12%	22
Region IV-A	3.6	0.1	26.4	27.4	-	-	71
Region III	2.5	0.6	26.1	26.8	-	-	51
Region V	2.4	0.6	26.8	27.4	640	10%	31
Region VII	2.1	0.6	26.9	27.5	150	2%	37
Bangsamoro Autonomous Region in Muslim Mindanao	2.1	0.5	26.5	27	600	14%	17
Region VIII	1.9	0.5	26.7	27.2	2,120	47%	24
Region I	1.8	0.5	26.2	26.7	280	5%	14
Region IV-B	-0.3	-0.1	26.2	26.1	370	12%	12



Top metrics under each category

Table 3.3.1.7: Average temperature change (% and °C), average temperature (°C), population impacted, annualized population impacted in 2030-2040 as a percent of total population (based on 2020 population figures), annualized economic impact (Bn PHP) in 2030-2040 by region, under SSP5-8.5 scenario

Note: Table sorted based on temperature change (%); Figures highlighted indicate top figures under respective metrics; Population exposed to extreme heat defined as population located in area exposed to heat index with a yearly average greater than 42°C

Note: The methodology employs 30-year baselines for historical variability when possible. In cases with only a decade of data available, 10-year baselines are used, maintaining forecast consistency with 10-year ranges.

Data source: Boston Consulting Group. (2023). Data Model on Extreme Heat and Droughts [Data model]. Retrieved from CMIP6 (Coupled Model Intercomparison Project Phase 6) database.



3.3.2 Sea level rise and extreme sea levels

Future global trends

Key takeaways

- Sea level rise will persist, with the extent and rate influenced by future emission scenarios (IPCC, 2021).
- The IPCC projects a global mean sea level rise of 0.20 to 0.29 meters by 2050 under the SSP5-8.5 scenario, compared to the 1995-2014 baseline (IPCC, 2021).
- By 2050, the frequency of extreme sea levels is projected to increase 20-30 times compared to 1900 (IPCC, 2021).
- Approximately 1 billion people globally potentially exposed to the impacts of sea level rise by 2050 (IPCC, 2021).

According to the AR6 report by IPCC, global mean sea level rise is projected to have significant impacts by 2050. Relative to the period of 1995-2014, the likely rise by 2050 ranges from 0.15 to 0.23 meters in the very low greenhouse gas (GHG) emissions scenario (SSP1-1.9) and 0.20 to 0.29 meters in the very high GHG emissions scenario (SSP5-8.5) (IPCC, 2021). These projections highlight the urgency of addressing climate change to mitigate the risks associated with sea level rise.

Figure 3.3.2.1 provides a comprehensive visualization of observed and projected global mean sea level changes, potential impacts, and time frames for coastal risk management. It also highlights that by 2050, extreme sea levels will become 20-30 times more frequent.

In addition to the scientific perspective, the human dimension cannot be ignored. Currently, approximately 896 million people, nearly 11% of the global population, reside in low-lying coastal zones (IPCC, 2021). By 2050, this number is projected to exceed 1 billion people exposed to sea level rise across all socioeconomic pathways (SSPs) (IPCC, 2021). This underscores the importance of implementing adaptation measures and coastal risk management strategies to protect vulnerable communities around the world.



Sea level rise will continue for millennia, but how fast and how much depends on future emissions

a) Sea level rise: observations and projections 2020-2100, 2150, 2300 (relative to 1900)

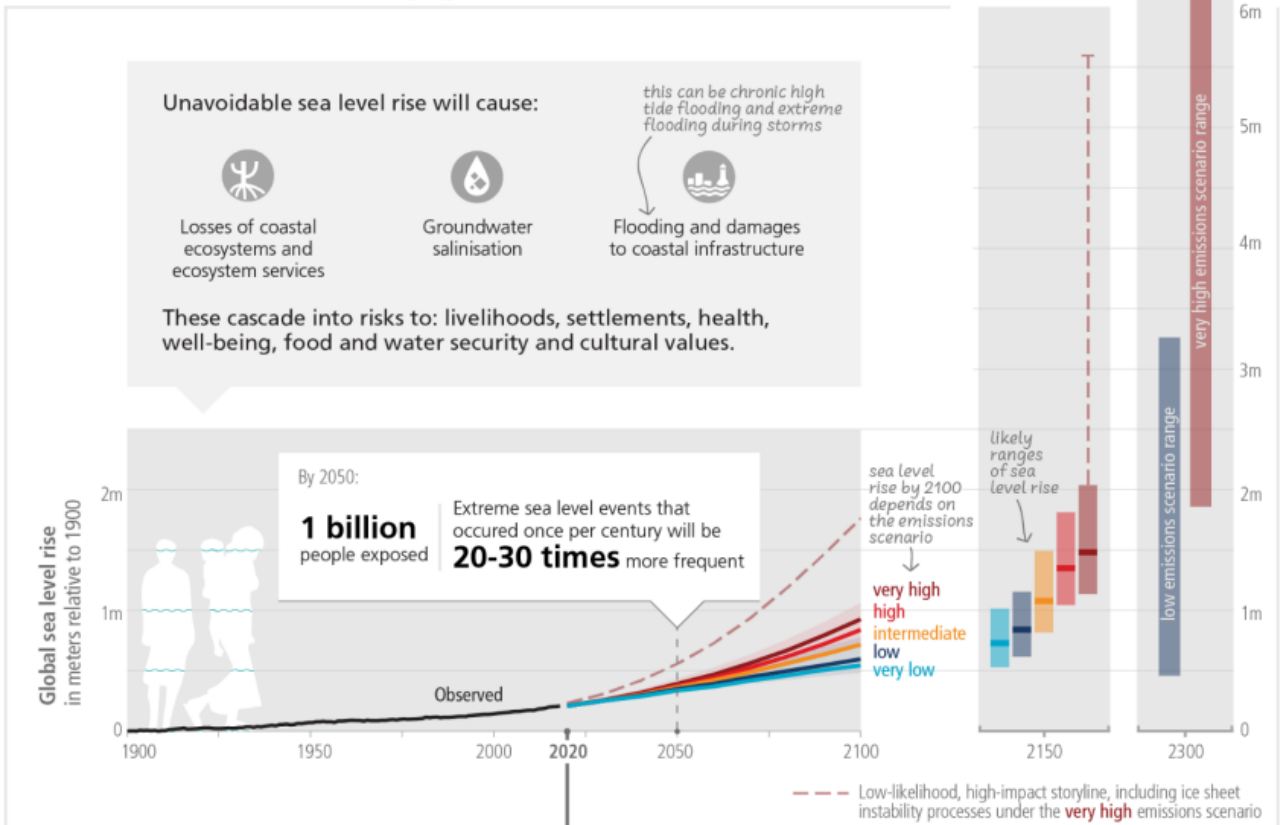


Figure 3.3.2.1: Global mean sea level change in meters relative to 1900. The historical changes (black) are observed by tide gauges before 1992 and altimeters afterwards. The future changes to 2100 and for 2150 (colored lines and shading) are assessed consistently with observational constraints based on emulation of CMIP, ice-sheet, and glacier models, and median values and likely ranges are shown for the considered scenarios.

Data source: Intergovernmental Panel on Climate Change Sixth Assessment Report Longer Report (2021) Figure 3.4 p.45



Potential Philippines trends

Key takeaways

Sea level rise

- The projected highest rate of sea level rise in the Philippines for the 2030 decade is 13mm per year, with an average of 5.4 mm (SSP2-4.5) to 6.6 mm (SSP5-8.5) per year. This represents a doubling of the global average rate documented in the IPCC AR5 Working Group I report of 2.8-3.6 mm per year from 1993-2010. By 2050, the rate is projected to increase further to 8.0 (SSP2-4.5) to 8.9 (SSP5-8.5) mm per year (Boston Consulting Group, 2023).
- In terms of absolute sea level rise, projections indicate a maximum increase of 0.25 meters by 2030 and 0.5 meters by 2050, relative to the 1995-2014 baseline (Boston Consulting Group, 2023). These figures represent a doubling of the projected global sea level rise of 0.29-0.29 meters by 2050, relative to the 1995-2014 period (Boston Consulting Group, 2023).

Extreme sea levels

- The 2030-2040 decade is anticipated to bring the possibility of extreme sea levels leading to a substantial increase in sea level, reaching up to 3 meters in the 10-year period (Boston Consulting Group, 2023). This magnitude is 12 times that of the sea level rise projection of 0.25 meters. Similar results are projected for the 2050 timeframe.

Sea level rise is a multifaceted phenomenon that encompasses both sea level rise and the occurrence of extreme sea levels. Sea level rise refers to the long-term increase in the average level of the oceans, while extreme sea levels are additional events that can exacerbate the impacts of sea level rise, such as storm surges and high tides. Sea level rise and extreme sea levels require different adaptation actions and hence, impacts of each will be displayed separately.

The main driver of sea level rise is a complex interplay of various factors. Factors contributing to sea level rise include Sterodynamic Sea Level, Glaciers, Land Water Storage, Ice Sheets, and Subsidence⁶⁸ (Boston Consulting Group, 2023).

⁶⁸ Oceanic Variability: Sea level change can arise from the natural variability in the ocean's circulation, temperature, and salinity. Large-scale climate signals like the seasonal cycle, El Niño Southern Oscillation (ENSO), North Atlantic Oscillation (NAO), and Pacific Decadal Oscillation (PDO) can influence sea level patterns.

Glaciers: Glaciers outside of the ice sheets, although accounting for only about 1% of total ice trapped on land, contribute to sea level rise. As these glaciers melt and discharge water into the oceans, it contributes to the overall rise in sea level.



In addition to sea level rise, extreme sea levels complement the overall impact. These events are characterized by their intensity and are measured in terms of their projected frequency of occurrence within specific return periods, such as 1 year, 10 years, or 100 years. Some components of extreme sea levels include Astronomical Tides, Storm Surge (including storm surges from typhoons and El Niño–Southern Oscillation), Waves, and Swash⁶⁹ (Boston Consulting Group, 2023).

The combination of permanent sea level rise and extreme sea events amplifies the risks and impacts faced by coastal areas.

Sea levels in the Philippines projected to rise at ~2x of historical global average by 2030⁷⁰

The projected rate of sea level rise for the period between 2030 decade (2030-2040) is projected to reach a maximum of 13mm per year (see Figure 3.3.2.5) within certain areas of the country, while the national average is projected to be between 5.4 mm (SSP2-4.5) to 6.6 mm (SSP5-8.5) per year (see Figure 3.3.2.2) (Boston Consulting Group, 2023), double the global average rate of 2.8-3.6 mm/year documented from 1993-2010 in the IPCC AR5 Working Group I report (IPCC, 2013).

The rate of sea level rise by 2050 decade (2050-2060) is projected to increase, with a nationwide average annual rate of sea level rise rising to 8.0 (SSP2-4.5) to 8.9 (SSP5-8.5) mm per year (see

Land Water Storage: Changes in the global water cycle, including groundwater withdrawal and water impoundment, can impact sea level. Variations in the transfer of water between land and ocean can influence the overall sea level measurements.

Ice Sheets: The Greenland and Antarctic ice sheets are massive reservoirs of ice. When these ice sheets melt or experience increased ice discharge into the ocean, it contributes to rising sea levels.

Subsidence: Subsidence refers to the movement of land at the coast, which can either be downward or upward. This movement can occur due to various physical processes, including groundwater and hydrocarbon withdrawal, tectonic activities, and glacial isostatic adjustment.

⁶⁹ **Astronomical Tides:** The gravitational attraction of the moon plays a role in the rise and fall of tides. Astronomical tides contribute to the overall sea level variations.

Storm Surge: Storm surges occur when low-pressure weather systems, such as typhoons or hurricanes, cause water to rise above the normal tide levels. Factors like the North Atlantic Oscillation (NAO), the Antarctic Oscillation (AAO), and the El Niño Southern Oscillation (ENSO) can influence the occurrence and intensity of storm surges.

Waves: Waves are created by the interaction between wind and the water surface. The energy transferred from the wind to the water can impact sea levels, especially during extreme weather events.

Swash: Swash refers to the turbulent effect that occurs when waves reach the shore. It can cause additional water to move up the beach and contribute to localized flooding.

⁷⁰ Methodology provided in appendix.



Figure 3.3.2.2), higher than the rates of both the historical and 2030 projections, indicating a generally faster pace of sea level rise felt across the country Boston Consulting Group, 2023).

In terms of absolute sea level rise, projections show an increase of sea levels up to 0.25 meters (see Figure 3.3.2.6), with a national average of 0.1 meters (see Figure 3.3.2.3), projected by 2030 compared to the baseline average sea level recorded in the Philippines from 1995-2014 (Boston Consulting Group, 2023).

By 2050, the absolute sea level rise is estimated to reach up to 0.5 meters (see Figure 3.3.2.6) compared to the baseline average sea level recorded from 1995-2014 (Boston Consulting Group, 2023), which is double the 2030 projection of 0.25m, and double the projected global sea level rise of 0.29-0.29 meters by 2050 in comparison to 1995-2014 (IPCC, 2021).

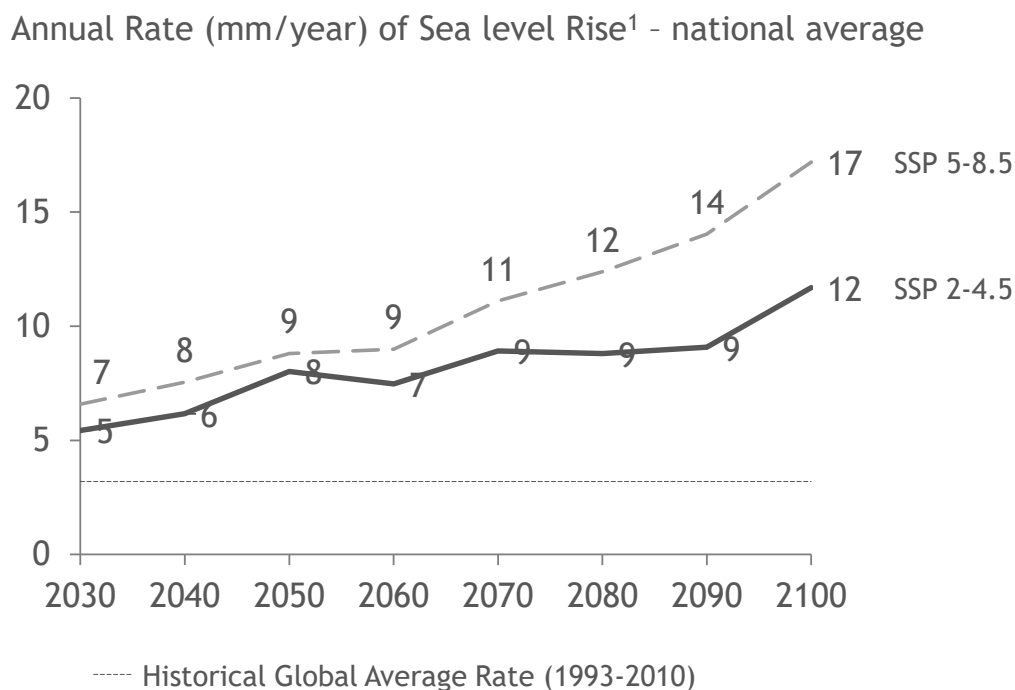
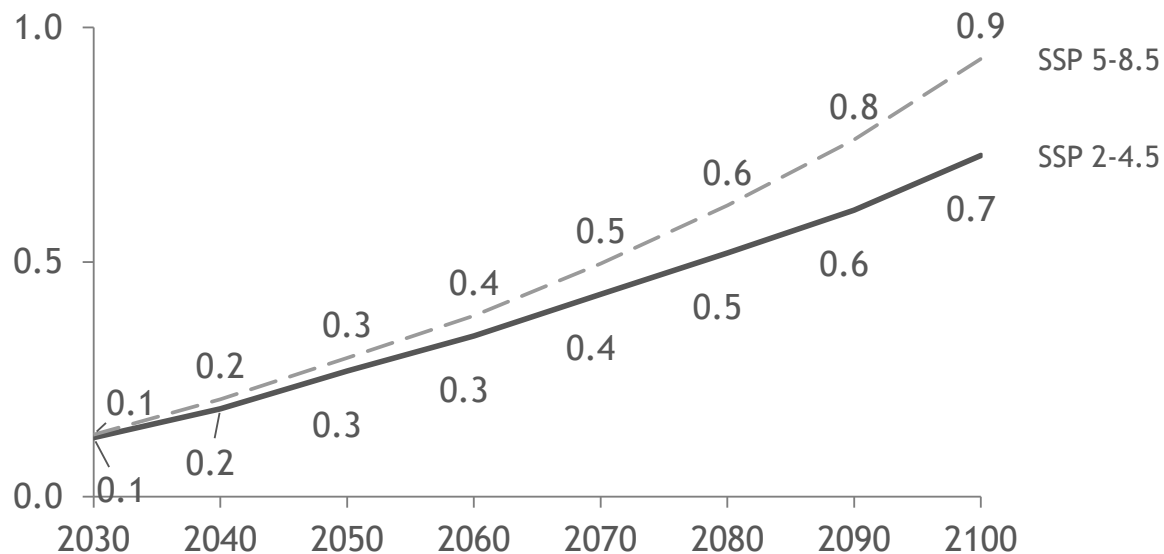


Figure 3.3.2.2: Annual rate of sea level rise (mm/year) in the Philippines up to 2100 under SSP2-4.5 and SSP5-8.5 scenarios (excluding vertical land motion)

Data source: Boston Consulting Group. (2023). Data Model on Sea Level Rise and Extreme sea levels [Data model]. Retrieved from IPCC AR6 Sea Level Projections, Coastal Futures, Nasa Earth data, and Alaska satellite facility databases.



Absolute Sea level rise (m)¹ - national average



1. Baseline: 1995-2014 average absolute sea level

Figure 3.3.2.3: Absolute sea level rise (meters) in the Philippines compared to country 1995-2014 baseline up to 2100 under SSP2-4.5 and SSP5-8.5 scenarios

Data source: Boston Consulting Group. (2023). Data Model on Sea Level Rise and Extreme sea levels [Data model]. Retrieved from IPCC AR6 Sea Level Projections, Coastal Futures, Nasa Earth data, and Alaska satellite facility databases.

Magnitude of extreme sea levels 12x greater than that of sea level rise by 2030

Regarding extreme sea levels, the sea level rise during a 10-year return period is projected to reach up to 3 meters (see Figure 3.3.2.8). This implies that in the 2030 decade, an extreme sea event could lead to a substantial increase in sea level of up to 3 meters, the magnitude of which is 12x that of the sea level rise (0.25m) in 2030 (see Figure 3.3.2.6) (Boston Consulting Group, 2023).

By 2050, the impact of extreme sea levels is projected to remain consistent with the 2030 projections. The potential 3-meter increase from an extreme event (see Figure 3.3.2.8) is 3x greater than the projected 0.5-meter increase in sea level rise (see Figure 3.3.2.6) (Boston Consulting Group, 2023).



Potential socio-economic impact

Key takeaways

Sea level rise

- By 2030 and 2050, up to 154,000 and 423,000 Filipinos, respectively, are at risk from permanent displacement due to sea level rise, with potential economic losses of PHP 18 Bn and PHP 41 Bn respectively (Boston Consulting Group, 2023).

Extreme sea levels

- Approximately 2 million people in the Philippines could be impacted by extreme flooding events by 2030 and 2050, translating to about PHP 80 Bn and PHP 88 Bn in infrastructure damage (Boston Consulting Group, 2023).

Socioeconomic Impact: Sea Level Rise	2030 decade (2030-2040 annualized average)		2050 decade (2050-2060 annualized average)	
	SSP2-4.5	SSP5-8.5	SSP2-4.5	SSP5-8.5
Social impact: Population exposed	75 K to 151 K	77 K to 154 K	240 K to 387 K	252 K to 423 K
Economic Impact: Infrastructure damage (PHP)	18 Bn	18 Bn	40 Bn	41 Bn

Socioeconomic Impact: Extreme Sea Levels	2030 decade (2030-2040 annualized average)		2050 decade (2050-2060 annualized average)	
	SSP2-4.5	SSP5-8.5	SSP2-4.5	SSP5-8.5
Social impact: Population exposed	1.7 Mn to 1.9 Mn	1.7 Mn to 1.9 Mn	1.8 Mn to 2.0 Mn	1.9 Mn to 2.0 Mn
Economic Impact: Infrastructure damage (PHP)	80 Bn	80 Bn	86 Bn	88 Bn

Table 3.3.2.1: Social and economic impact of sea level rise and extreme sea events



Note: Figures provided are approximations; Note: Population impacted defined as population located in area flooded with at least 30cm to 50cm of water for sea level rise

Data source: Boston Consulting Group. (2023). Data Model on Sea Level Rise and Extreme sea levels [Data model]. Retrieved from IPCC AR6 Sea Level Projections, Coastal Futures, Nasa Earth data, and Alaska satellite facility databases.

The coastal flooding analysis was conducted using a comprehensive approach that integrated several crucial factors. These factors include the absolute increase in sea level rise, land elevation, land subsidence, and the projected occurrence of extreme sea levels. By combining these inputs, a detailed assessment of potential flood depth was obtained.

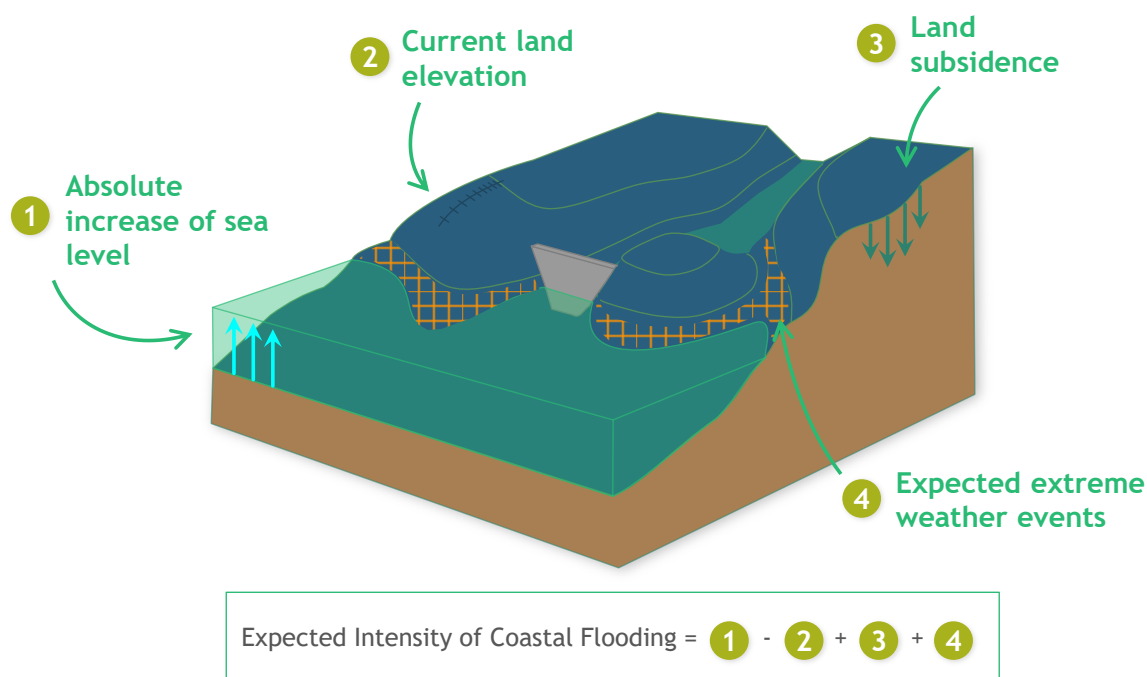


Figure 3.3.2.4: Coastal flooding model methodology to calculate projected intensity of coastal flooding in the Philippines

Data source: Boston Consulting Group. (2023). Data Model on Sea Level Rise and Extreme sea levels [Data model]. Retrieved from IPCC AR6 Sea Level Projections, Coastal Futures, Nasa Earth data, and Alaska satellite facility databases.



Up to 154,000 and 423,000 Filipinos exposed to sea level rise, with potential economic losses of about PHP 18 Bn and PHP 41 Bn by 2030 and 2050⁷¹

Overall, by 2030, flooding from sea level rise translates to potentially 77,000 to 154,000 people impacted (SSP5-8.5), defined being in area flooded with at least 30cm to 50cm of water for sea level rise (Boston Consulting Group, 2023). Looking towards 2050, the number of people affected is projected to increase to around 252,000 to 423,000 individuals (SSP5-8.5) (Boston Consulting Group, 2023).

Sea Level Rise is forecasted to cause to PHP 18 Bn in infrastructure damage by 2030, which escalates to PHP 41 Bn by 2050 (Boston Consulting Group, 2023). These figures highlight the growing magnitude of the challenges posed by sea level rise and the urgent need for effective adaptation and mitigation measures.

Up to 2 million potential Filipino population impacted by extreme flooding events, with potential economic losses of about PHP 80 Bn and PHP 88 Bn by 2030 and 2050⁷²

Overall, floods from extreme sea levels would result in the displacement and disruption of up to 2 million individuals by 2030 and 2050 (SSP5-8.5) (Boston Consulting Group, 2023).

Extreme sea levels are forecasted to cause up to PHP 80 Bn in infrastructure damage by 2030 and nearly PHP 88 Bn by 2050 (Boston Consulting Group, 2023). These figures underscore the ongoing and escalating challenges posed by extreme flooding events, highlighting the urgent need for robust adaptation and mitigation strategies to safeguard vulnerable communities and regions.

Most impacted regions

Key takeaways

Sea level rise

- Luzon, particularly provinces facing the South China Sea, will experience a 1.5 times faster pace of sea level rise compared to the national average, with up to 8.0mm/year by 2030 and up to 10.3mm/year by 2050 (Boston Consulting Group, 2023).
- Regions in Luzon to bear highest average flooding depths
 - Regions III (Central Luzon), IV-A (CALABARZON), and II (Cagayan Valley) are projected to bear the highest average flooding levels of about 0.27-0.29 meters, while regions III, IV-B (MIMAROPA), and I (Ilocos Region) are projected to experience the highest maximum flooding depth of 0.7 to 1.0 meters by 2030 under the SSP8-5.8 scenario (Boston Consulting Group, 2023).
- Socioeconomic impacts of sea level rise highest in Luzon regions:

⁷¹ Methodology provided in appendix.

⁷² Methodology provided in appendix.



- By 2030 under the SSP5-8.5 scenario, up to 74% (114k of 154k) of the total impacted population by sea level rise flooding will come from regions III (Central Luzon), IV-A (CALABARZON), and I (Ilocos region) (Boston Consulting Group, 2023).
- Regions III (Central Luzon), I (Ilocos Region), and V (Bicol Region) in Luzon are projected to collectively account for 68% (PHP 12 billion of PHP 18 billion) of the total infrastructure damage attributed to sea level rise by 2030 under SSP5-8.5 scenario (Boston Consulting Group, 2023).

Extreme sea levels

- The effects of extreme sea levels are projected to be more pronounced in the eastern regions, specifically in regions V (Bicol Region), II (Cagayan Valley), and VIII (Eastern Visayas). However, from 2030 to 2050, the National Capital Region (NCR) and region IV-B (MIMAROPA) are projected to experience significant increases in sea level from extreme events (Boston Consulting Group, 2023).
- Regions VIII (Eastern Visayas), II (Cagayan Valley), and XIII (Caraga) primarily located in the eastern areas of the country are projected to experience the highest average flood intensity levels of about 0.9 to 1.0 meters by 2030 under the SSP5-8.5 scenario. In terms of maximum flooding, regions V (Bicol Region), II (Cagayan Valley), and VIII (Eastern Visayas) are projected to have the highest levels from extreme sea levels (Boston Consulting Group, 2023).
- Socioeconomic impact of extreme sea events highest in Visayas regions
 - By 2030 under the SSP5-8.5 scenario, 34% (648k of 1.9 million) of the total impacted population by extreme sea levels is projected to come from regions VII (Central Visayas), VI (Western Visayas), and VIII (Eastern Visayas) in Visayas (Boston Consulting Group, 2023).
 - Regions VII (Central Visayas) and VIII (Eastern Visayas), along with Region V (Bicol region) in southeastern Luzon, are projected to bear 37% (PHP 30 billion of PHP 80 billion) of infrastructure damage from extreme sea events (Boston Consulting Group, 2023).

Luzon faces accelerated sea level rise compared to rest of the country

Luzon, experiencing a significantly faster rate of sea level rise compared to the national average. In particular, the provinces of NCR, Bulacan, Zambales, and Batangas, all with coastal areas facing the south China sea are projected to experience high rates of sea level rise (see Table 3.3.2.2) (Boston Consulting Group, 2023).

This trend continues into 2050 decade, with Luzon projected to experience a rate of sea level rise that is approximately 1.1 times faster than the national average (Boston Consulting Group, 2023). By 2050 decade, the projected annual rate of sea level rise in the Luzon is estimated to be 9.4 mm/year (SSP2-4.5) to 10.3 mm/year (SSP5-8.5), surpassing the projected national average of 8.8 to 8.9 mm/year (Boston Consulting Group, 2023).

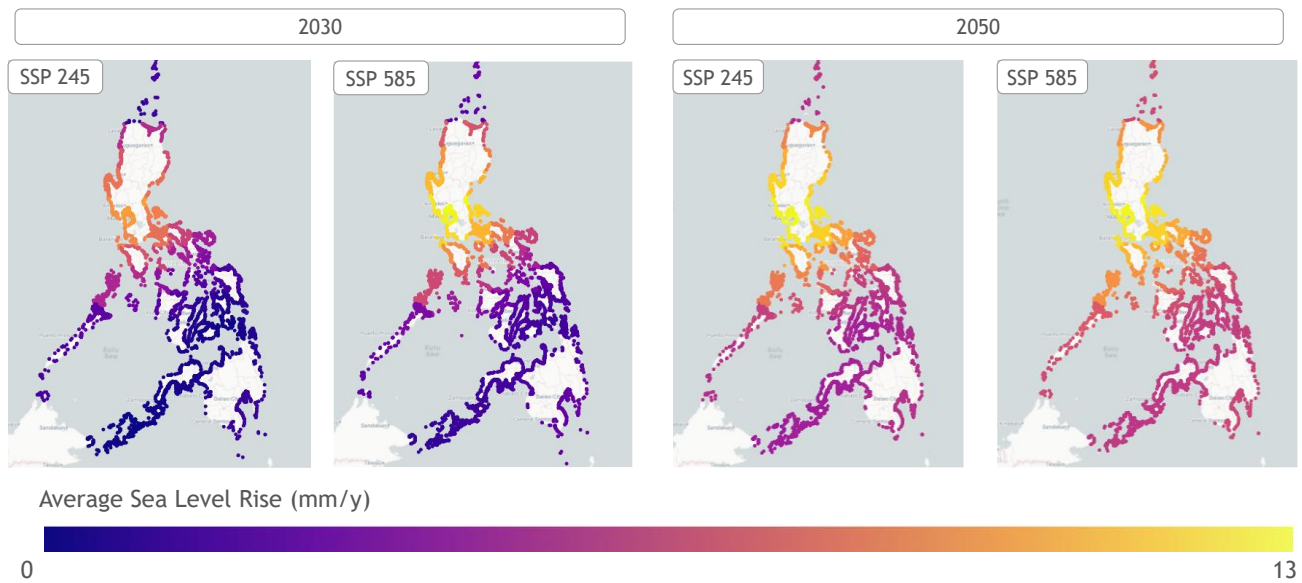


Figure 3.3.2.5: Average sea level rise (mm/year) across areas in the Philippines by 2030 (2030-2040 rate) and 2050 (2050-2060 rate) decades under SSP2-4.5 and SSP5-8.5 scenarios

Data source: Boston Consulting Group. (2023). Data Model on Sea Level Rise and Extreme sea levels [Data model]. Retrieved from IPCC AR6 Sea Level Projections, Coastal Futures, Nasa Earth data, and Alaska satellite facility databases.

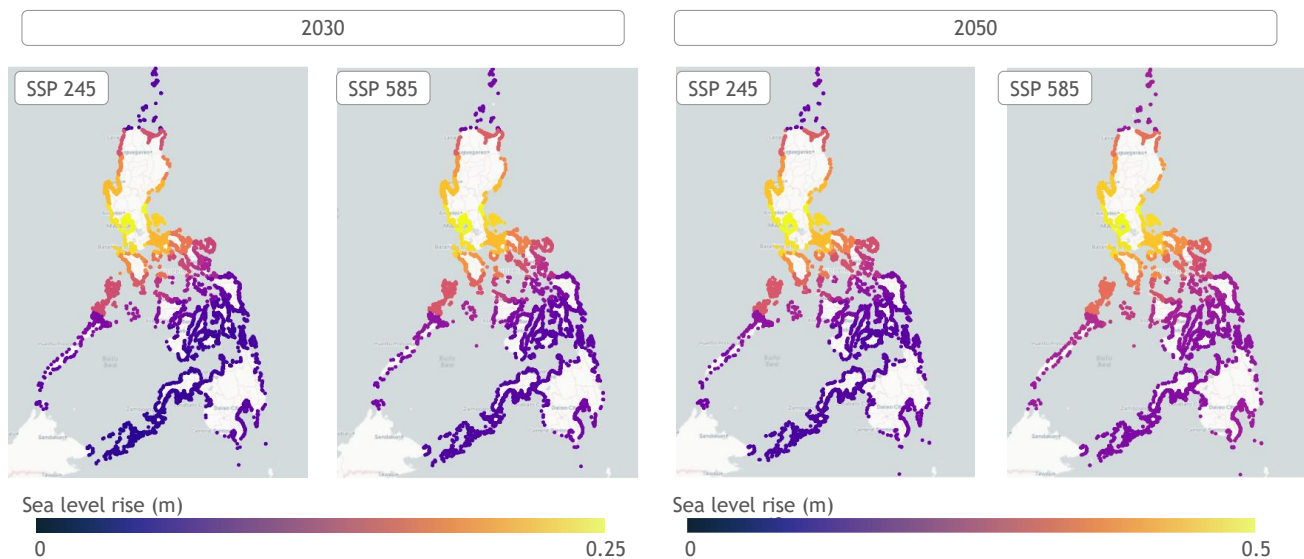


Figure 3.3.2.6: Absolute sea level rise (meters) across areas in the Philippines by 2030 and 2050 under SSP2-4.5 and SSP5-8.5 scenarios compared to 1990-2014 baseline

Data source: Boston Consulting Group. (2023). Data Model on Sea Level Rise and Extreme sea levels [Data model]. Retrieved from IPCC AR6 Sea Level Projections, Coastal Futures, Nasa Earth data, and Alaska satellite facility databases.



Area	SLR rate 2030 decade – mm/year (SSP2-4.5 to SSP5-8.5)	SLR rate 2050 decade – mm/year (SSP2-4.5 to SSP5-8.5)
Nationwide	5.4 to 6.6	8.9 to 8.8
Luzon	6.9 to 8.0	9.4 to 10.3
NCR	9.6 to 10.7	12.1 to 12.9
Bulacan	9.7 to 10.8	12.0 to 13.0
Zambales	9.4 to 11.9	12.1 to 12.9
Batangas	9.2 to 10.3	11.8 to 12.6
Visayas	4.0 to 5.2	6.7 to 7.4
Cebu	3.9 to 5.1	6.6 to 7.3
Mindanao	3.8 to 5.0	6.4 to 7.2
Davao	4.2 to 4.5	6.8 to 7.5
Sulu	0.1	0.2

Table 3.3.2.2: Rate of sea level rise (mm/year) across key areas in the Philippines by 2030 (2030-2040) and 2050 (2050-2060) under SSP2-4.5 and SSP5-8.5 scenarios

Data source: Boston Consulting Group. (2023). Data Model on Sea Level Rise and Extreme sea levels [Data model]. Retrieved from IPCC AR6 Sea Level Projections, Coastal Futures, Nasa Earth data, and Alaska satellite facility databases.

Sea level rise flooding depth highest in Luzon regions^{73 74}

Taking sea level rise into account and incorporating current land elevation and land subsidence data, it's projected that by 2030, Regions III (Central Luzon), IV-A (CALABARZON), and II (Cagayan Valley) are expected to face the highest average flooding levels – about 0.27-0.29 meters. Additionally, regions III (Central Luzon), IV-B (MIMAROPA), and I (Ilocos) are projected to experience the highest maximum flooding depth (0.7 to 1.0 meters), indicating their heightened vulnerability to sea level rise (Boston Consulting Group, 2023).

⁷³ Note: Flooding projections do not consider existing adaptive capacity and man-made barriers on SLR inland propagation

⁷⁴ Methodology provided in appendix.



Socioeconomic impacts of sea level rise highest in Luzon regions

In terms of population impacted, regions III (Central Luzon), IV-A (CALABARZON), and I (Ilocos) in Luzon are projected to have the largest number of people impacted by sea level rise flooding by 2030 under the SSP5-8.5 scenario, representing 74% (114K of 154K) of the total impacted population exposed to sea levels of at least 30cm (Boston Consulting Group, 2023).

Regions III (Central Luzon), I (Ilocos), and V (Bicol), all located in Luzon, are collectively estimated to account for PHP 12 Bn of PHP 18 Bn, or 68%, of the total infrastructure damage attributed to sea level rise by 2030 under the SSP5-8.5 scenario. This underscores the imperative for heightened preparedness measures in these regions (Boston Consulting Group, 2023).

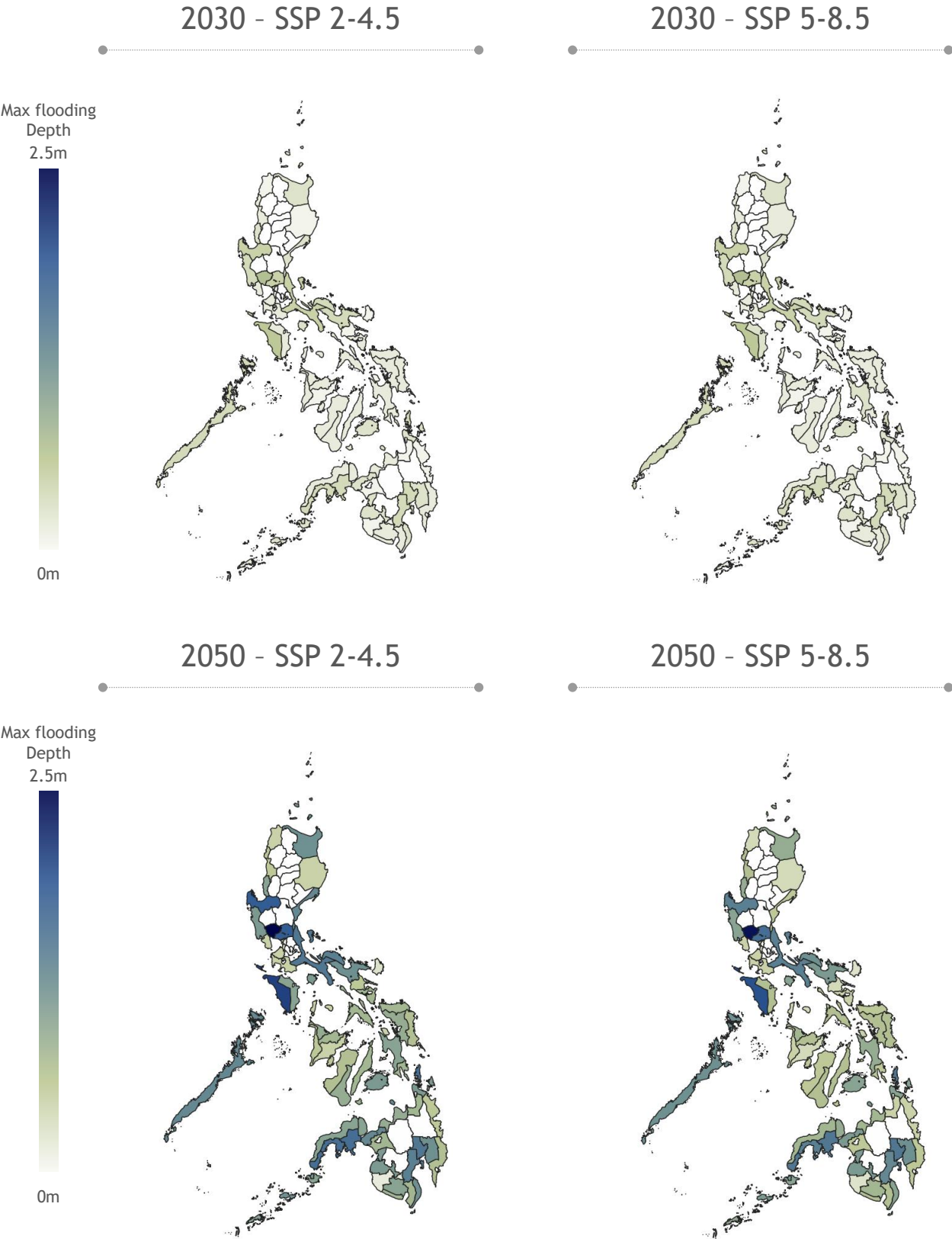




Figure 3.3.2.7: Maximum flooding depth (meters) from sea level rise under SSP2-4.5 and SSP5-8.5 scenario by 2030-2040 and 2050-2060 decades

Data source: Boston Consulting Group. (2023). Data Model on Sea Level Rise and Extreme sea levels [Data model]. Retrieved from IPCC AR6 Sea Level Projections, Coastal Futures, Nasa Earth data, and Alaska satellite facility databases.



Region	Average flooding (meters)	Max flooding (meters)	Pop. Impacted (k people)	% of total population (2020 population)	Area Impacted (sq km)	% of total area impacted	Economic impact (PHP Bn)
Region III	0.29	1.04	30-69	0.2% - 0.6%	16-35	0%	3.4
Region IV-A	0.28	0.63	23-24	0.1%-0.2%	8-11	0%	1.3
Region II	0.27	0.57	2-2	0.1%	4-7	0%	0.2
National Capital Region	0.24	0.24	0-0	0.0%	0-1	0%	0.3
Region IV-B	0.23	0.75	3-3	0.1%	7-13	0%	0.3
Region XIII	0.22	0.48	0-0	0.0%	0-1	0%	0.1
Region XI	0.22	0.45	0-1	0.0%	1-2	0%	0.4
Region I	0.21	0.72	0-21	0.0% - 0.4%	2-10	0%	1.9
Region V	0.18	0.46	3-8	0.1%	7-11	0%	7.0
Region X	0.16	0.44	0-1	0.0%	2-3	0%	0.4
Region IX	0.15	0.48	7-8	0.2%	9-10	0%	0.3
Region VIII	0.15	0.38	1-6	0.0% - 0.1%	3-10	0%	0.7
Bangsamoro Autonomous Region in Muslim Mindanao	0.14	0.40	4-4	0.1%	6-7	0%	0.2



Region VI	0.13	0.42	1-2	0.0%	1-3	0%	0.7
Region VII	0.13	0.41	3-5	0.0%-0.1%	2-4	0%	0.8
Region XII	0.09	0.09	0-1	0.0%	0-1	0%	0.0

Top metrics under each category

Table 3.3.2.3: Average depth of areas flooded (meters) within regions due to sea level rise, maximum depth of areas flooded (meters), population impacted range, percent of total population impacted using 2020 population figures, area impacted, percent of total area impacted, and economic impact under SSP5-8.5 scenario by 2030-2040 decade

Note: Table sorted based on average flooding (meters); CAR region not impacted by sea level rise or extreme sea levels; figures highlighted indicate top figures under respective metrics; population and area impacted defined as population and area located in area flooded with at least 30cm to 50cm of water; Flooding projections do not consider existing adaptive capacity and man-made barriers on SLR inland propagation

Data source: Boston Consulting Group. (2023). Data Model on Sea Level Rise and Extreme sea levels [Data model]. Retrieved from IPCC AR6 Sea Level Projections, Coastal Futures, Nasa Earth data, and Alaska satellite facility databases.



Extreme sea levels to be more intense in eastern regions of the country⁷⁵

While the impact of sea level rise is primarily concentrated in the central and northern areas of the Philippines, the effects of extreme sea levels are more pronounced in the eastern regions, specifically in regions V (Bicol Region), II (Cagayan Valley), and VIII (Eastern Visayas), where the sea level rise from extreme events are more sizable (see Figure 3.3.2.9) (Boston Consulting Group, 2023).

In 2050, the effects of extreme levels will continue to be predominantly felt in the eastern areas of the Philippines (Boston Consulting Group, 2023). However, it is important to note that regions in Luzon, particularly the National Capital Region (NCR) and region IV-B (MIMAROPA), are projected to experience significant increases in sea level from extreme levels (see Figure 3.3.2.9) (Boston Consulting Group, 2023). These regions are projected to have sea level rises of approximately 8-13% and 9-12%, respectively, from 2030 to 2050 (Boston Consulting Group, 2023).

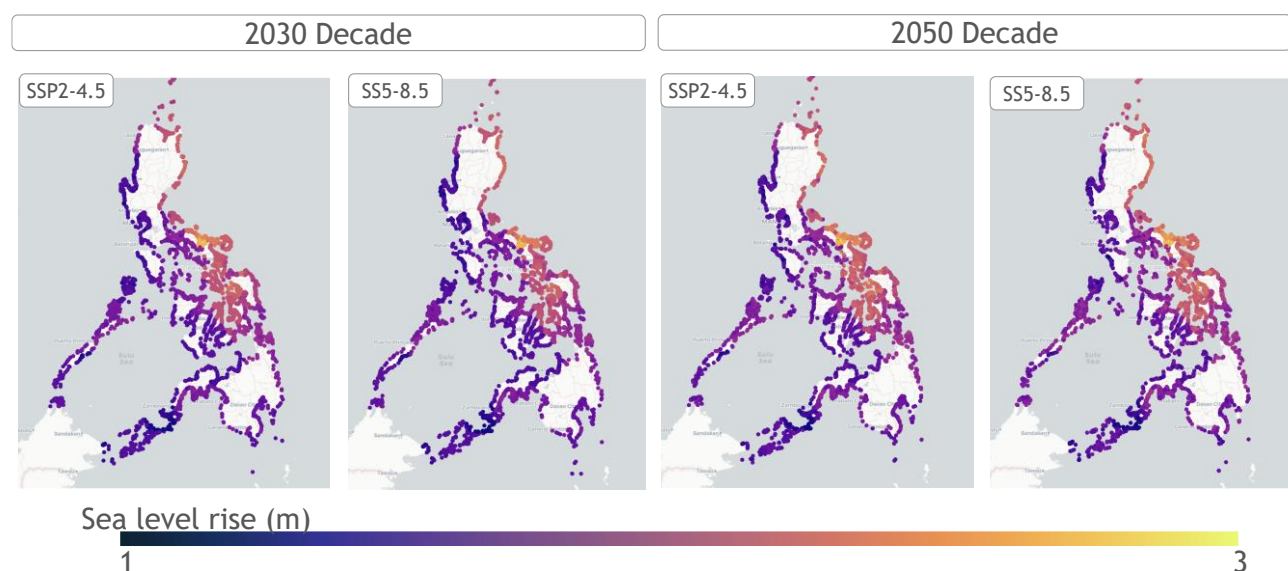


Figure 3.3.2.8: Extreme sea level rise (meters) across areas in the Philippines in 2030-2040 and 2050-2060 under SSP2-4.5 and SSP5-8.5 scenarios

Data source: Boston Consulting Group. (2023). Data Model on Sea Level Rise and Extreme sea levels [Data model]. Retrieved from IPCC AR6 Sea Level Projections, Coastal Futures, Nasa Earth data, and Alaska satellite facility databases.

⁷⁵ Methodology provided in appendix.

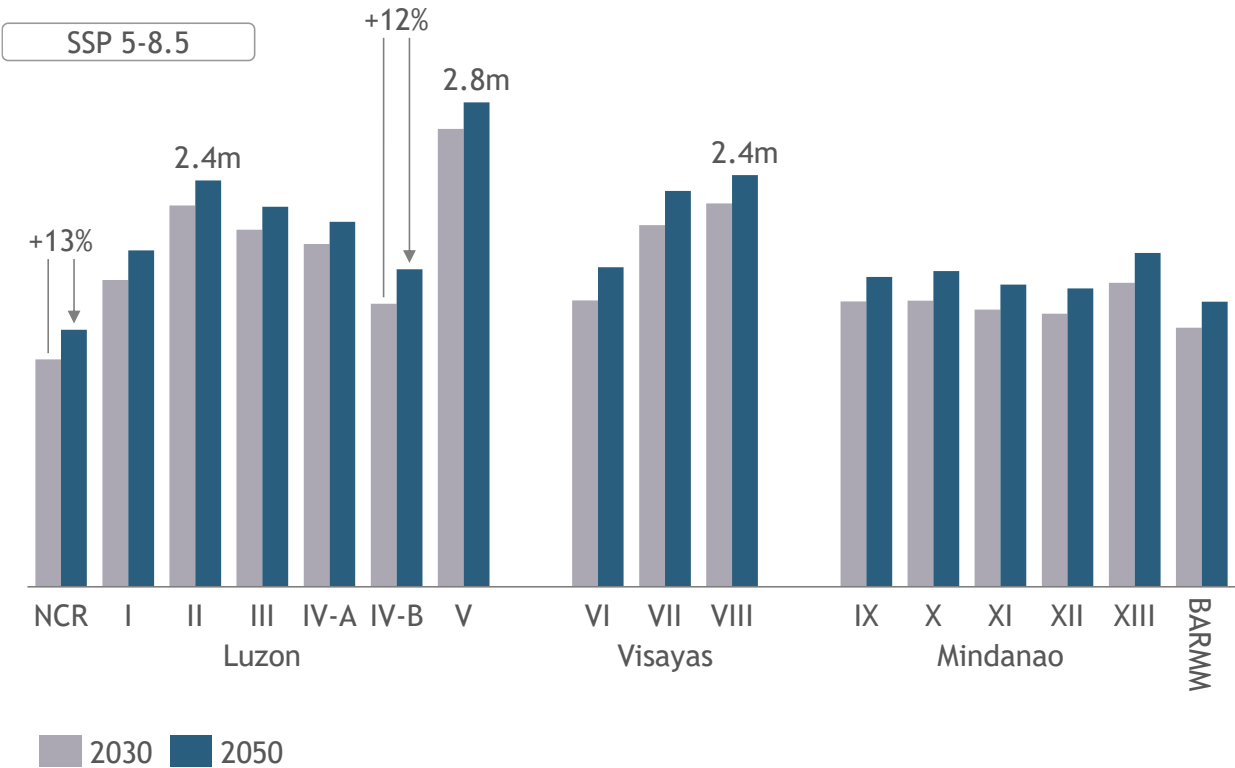
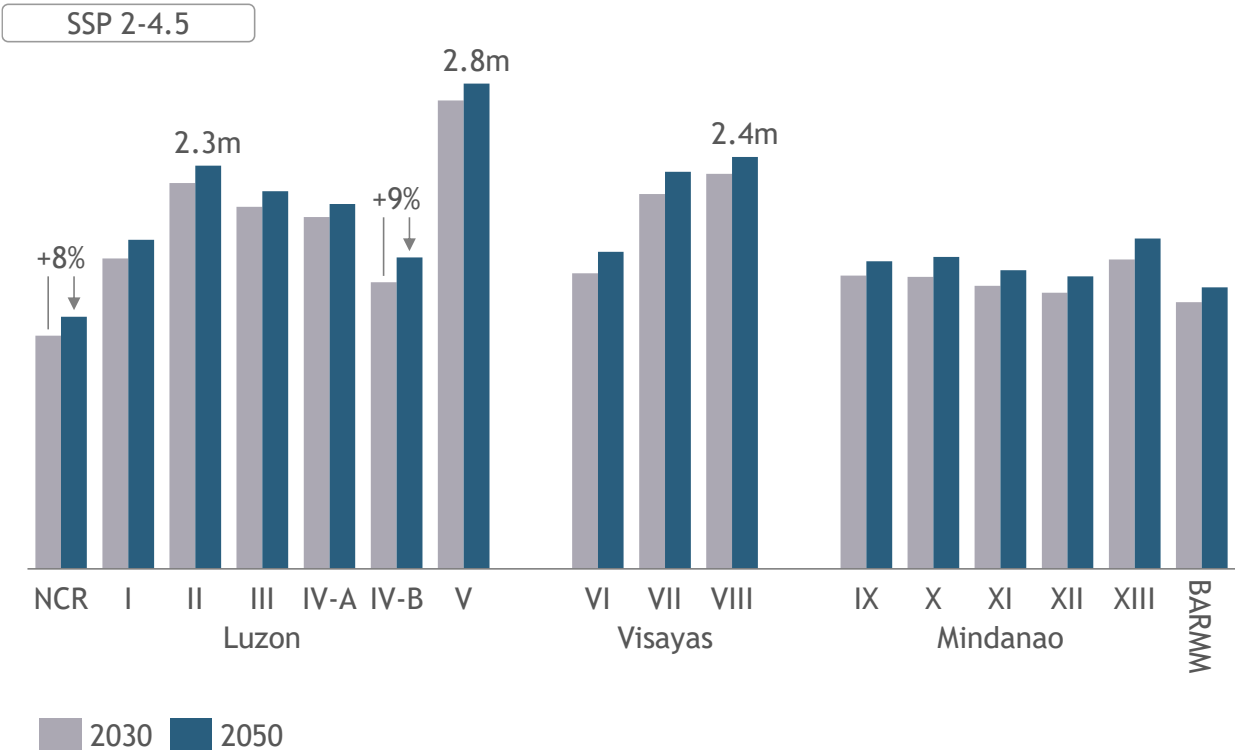




Figure 3.3.2.9: Extreme sea level rise (meters) per region within 2030-2040 and 2050-2060 decades under SSP2-4.5 and SSP5-8.5 scenarios

Data source: Boston Consulting Group. (2023). Data Model on Sea Level Rise and Extreme sea levels [Data model]. Retrieved from IPCC AR6 Sea Level Projections, Coastal Futures, Nasa Earth data, and Alaska satellite facility databases.

Extreme sea levels flooding depth projected to concentrate in the eastern regions

In the coming decade of 2030, regions VIII (Eastern Visayas), II (Cagayan Valley), and XIII (Caraga), primarily on the eastern areas of the country, are projected to experience the highest average flood intensity levels – about 0.9 to 1.0 meters by 2030 under the SSP5-8.5 scenario (Boston Consulting Group, 2023). In terms of maximum flooding, regions V (Bicol), II (Cagayan Valley), and VIII (Eastern Visayas) are projected to have the highest maximum flooding levels from extreme sea levels (Boston Consulting Group, 2023).

The Visayas regions, specifically Regions VII (Central Visayas), VI (Western Visayas), and VIII (Eastern Visayas), are anticipated to shoulder the most significant socioeconomic repercussions arising from extreme sea levels

By 2030 under the SSP5-8.5 scenario, these regions are projected to account for 34% (648,000 out of 1.9 million) of the total population impacted. Furthermore, regions VII, VIII, in conjunction with Region V (Bicol) in southeastern Luzon, are expected to bear 37% of the infrastructure damage resulting from extreme sea levels, amounting to nearly PHP 30 billion out of PHP 80 billion, by 2030 under the SSP5-8.5 scenario (Boston Consulting Group, 2023).

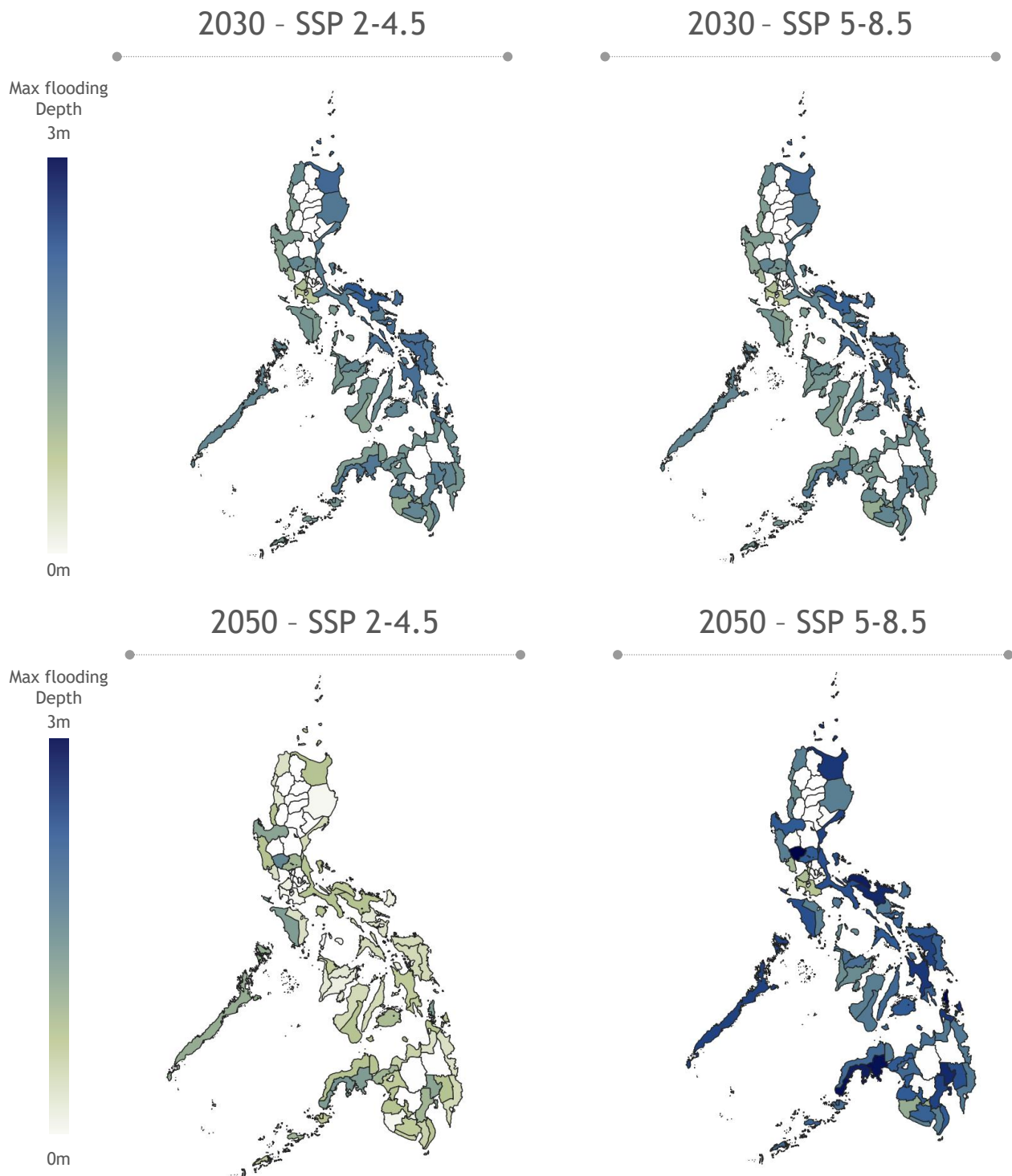


Figure 3.3.2.10: Maximum flooding depth (meters) from extreme sea levels under SSP2-4.5 and SSP5-8.5 scenario by 2030-2040 decade



Data source: Boston Consulting Group. (2023). Data Model on Sea Level Rise and Extreme sea levels [Data model]. Retrieved from IPCC AR6 Sea Level Projections, Coastal Futures, Nasa Earth data, and Alaska satellite facility databases.



Region	Average flooding (meters)	Max flooding (meters)	Pop. Impacted (k people)	% of total population (2020 population)	Area Impacted (sq km)	% of total area impacted	Economic impact (PHP)
Region VIII	1.00	2.26	181-183	4%	210-230	0% - 1%	9
Region II	0.95	2.30	18-18	0%	60-60	0% - 0%	1
Region XIII	0.93	1.97	44-44	2%	70-70	0% - 0%	2
Region V	0.92	2.75	155-161	3%	260-290	1% - 2%	10
Region VII	0.78	1.97	253-280	3%	90-120	1% - 1%	10
Region XI	0.74	1.70	88-94	2%	30-50	0% - 0%	3
Region IX	0.72	1.92	96-105	2%-3%	160-200	1% - 1%	3
Region VI	0.71	1.83	146-185	2%	120-190	1% - 1%	7
Region XII	0.68	1.41	37-40	1%	10-20	0% - 0%	1
Region I	0.67	1.79	116-125	2%	90-200	1% - 2%	6
Region IV-B	0.67	1.78	65-84	2%-3%	90-150	0% - 1%	4
Region III	0.64	1.90	167-176	1%	140-300	1% - 1%	8
Region X	0.63	1.76	112-126	2%	30-50	0% - 0%	4
Bangsamoro Autonomous Region in Muslim Mindanao	0.62	1.61	60-81	1% - 2%	60-100	0% - 1%	2



Region IV-A	0.61	2.16	120-140	1%	80-100	0% - 1%	5
National Capital Region	0.46	1.09	69-84	1%	2-10	0%- 2%	5

Top metrics under each category

Table 3.3.2.4: Average depth of areas flooded (meters) within regions due to extreme sea events, maximum depth of areas flooded (meters), population impacted range, percent of total population impacted using 2020 population figures, area impacted, percent of total area impacted, and economic impact under SSP5-8.5 scenario by 2030-2040 decade

Note: Table sorted based on average flooding (meters); Figures highlighted indicate top figures under respective metrics; CAR region not impacted by sea level rise or extreme sea levels; population and area impacted defined as population and area located in area flooded with at least 30cm to 60cm of water; Flooding projections do not consider existing adaptive capacity and man-made barriers on SLR inland propagation

Data source: Boston Consulting Group. (2023). Data Model on Sea Level Rise and Extreme sea levels [Data model]. Retrieved from IPCC AR6 Sea Level Projections, Coastal Futures, Nasa Earth data, and Alaska satellite facility databases.



3.3.3 Extreme precipitation

Future global trends

Key takeaways

- Extreme daily precipitation events projected to intensify by about 7% for every 1°C increase in global temperature (IPCC, 2021).
- At 1.5°C of warming, Asia will experience intensified heavy precipitation and increased flood risks. These changes will become more widespread and significant at 2°C or higher global warming.
- Rain generated local flooding is projected to increase with heavier precipitation events.

One key impact of global warming is the projected intensification and increased frequency of heavy precipitation events worldwide. According to the AR6 report by the IPCC, projected changes in heavy precipitation are larger in frequency and intensity with every additional increment of global warming (IPCC, 2021). Heavy precipitation will become more severe with additional global warming, with extreme daily precipitation events projected to intensify by about 7% for every 1°C increase in global temperature. At 1.5°C of warming, Asia, including the Philippines, will experience intensified heavy precipitation and increased flood risks (IPCC, 2021). These changes will become more widespread and significant at 2°C or higher global warming (IPCC, 2021). Consequently, rain-generated local flooding is projected to increase as heavy precipitation events become more frequent.

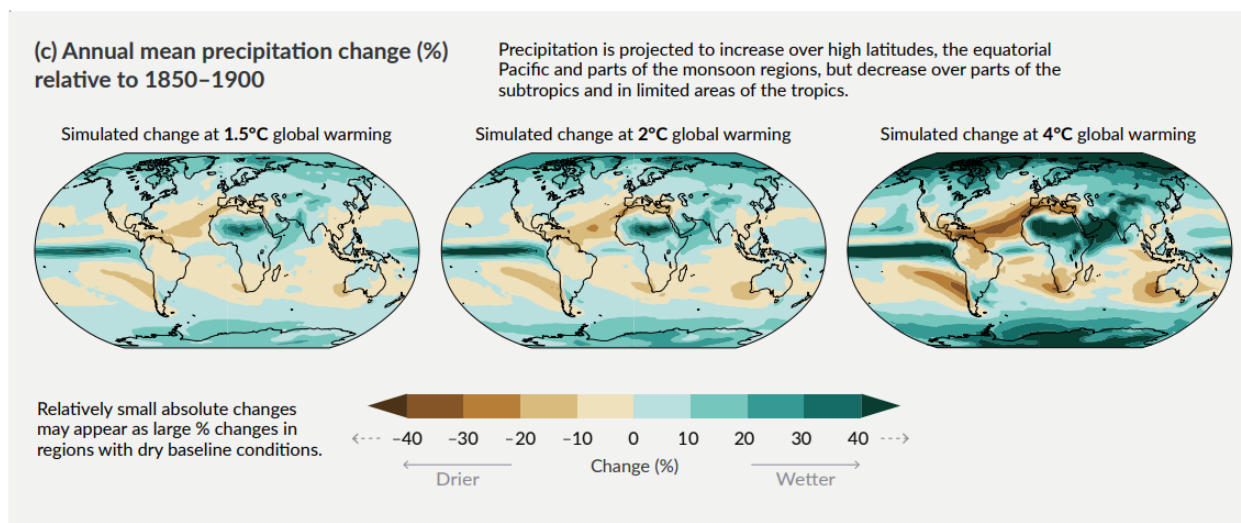


Figure 3.3.3.1: Annual mean precipitation change (%) relative to 1850–1900 across global warming scenarios

Data Source: Intergovernmental Panel on Climate Change Sixth Assessment Report Summary for Policy Makers (2021) Figure SPM.5 p.17



Potential Philippines trends

Key takeaways

- Number of days with intense precipitation (days with precipitation greater than 20mm) is projected to slightly increase from 20-25 days to around 22-27 days by 2050 (range of scenarios SSP2-4.5 and SSP5-8.5) (World Bank Group, 2022).
- Changes in precipitation will vary across different parts in the Philippines:
 - Areas that may get wetter (more total precipitation on average): Eastern areas in mid-section of the country (historically categorized as climate type II⁷⁶) and central and eastern areas of Luzon (historically categorized as climate types I, III, and IV) (Boston Consulting Group, 2023).
 - Areas that may get drier (less total precipitation on average): Northeastern portions of Luzon and southern areas of Mindanao (historically encompassing areas classified as either type III or IV)
- Analysis of seasonal distribution of precipitation project an increasing overall precipitation by 2030 (2021-2040 annualized average) and 2050 (2041-2060 annualized average) with September-October-November season projected to have the highest increase in levels of precipitation. By 2050, projections show drier dry seasons in March-April-May, but wetter seasons throughout the rest of the year (Boston Consulting Group, 2023).

Variable precipitation patterns predicted, with potentially increasing intensity

The projections for precipitation patterns in the Philippines indicate that the overall average annual precipitation level will remain in the range of 2500mm (see Figure 3.3.3.2) (World Bank Group, 2022). However, the behavior of precipitation is projected to become more variable, with the number of days with more intense precipitation potentially increasing. As shown in Figure 3.3.3.2, the Philippines historically had between 20 to 25 days with precipitation exceeding 20mm/day, and rarely more than 40 days (World Bank Group, 2022). Under most scenarios, the average number of such days will increase to 22-27 days under SSP2-4.5 and SSP5-8.5 scenarios and by 2050, and in some years may even approach 50 days (World Bank Group, 2022).

⁷⁶ Climate types based on Modified Coronas Classification System: Type I – Two pronounced seasons: Dry from November to April, wet during the rest of the year; Type II – No dry season with a very pronounced rainfall from November to April and wet during the rest of the year; Type III – Seasons are not very pronounced; relatively dry from November to April, wet during the rest of the year; Type IV – Rainfall is more or less evenly distributed through the year

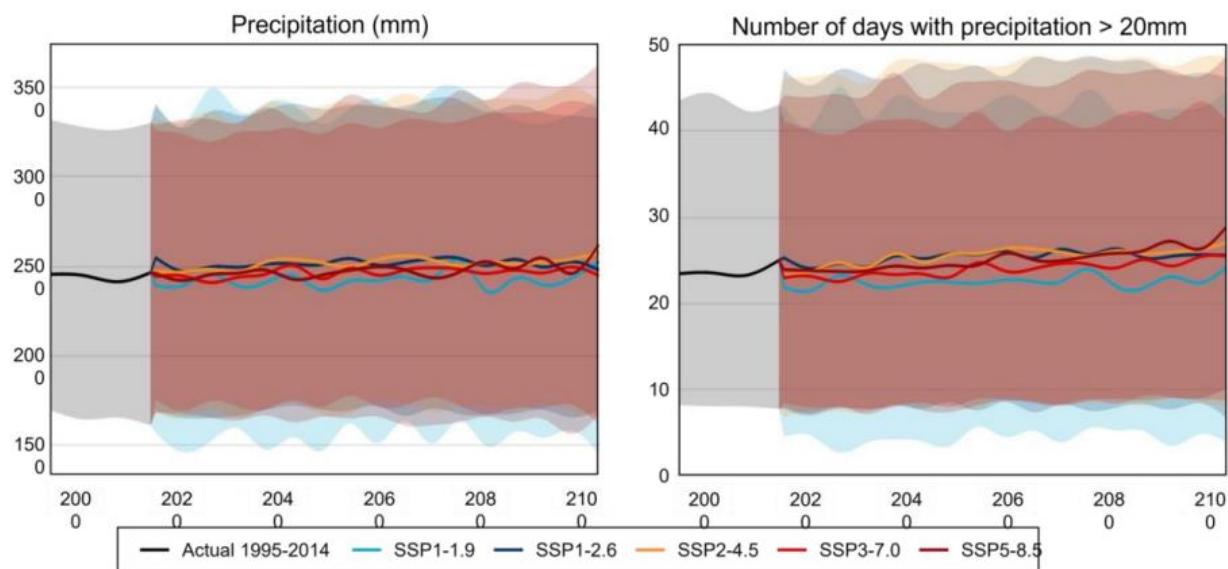


Figure 3.3.3.2: Historical and projected average precipitation in the Philippines (mm) across scenarios (Left side); Historical and projected number of days with precipitation greater than 20mm across scenarios

Data source: World Bank Group. (2022). Philippines Climate Change and Disaster Risk (CCDR) full report. Washington, D.C.: World Bank. Figure A.2 page 75

Changes in precipitation are projected to vary spatially

The spatial distribution of precipitation behavior also will experience variations (see Figure 3.3.3.5).

Areas prone to increased precipitation (greater average total rainfall compared to the baseline) include:

- Eastern areas located in the mid-section of the country. These regions have traditionally been categorized as climate type II⁷⁷ due to their consistent rainfall distribution, resulting in the absence of dry seasons. The projections indicate a further intensification of precipitation in these already wet regions (Boston Consulting Group, 2023).

⁷⁷ Climate types based on Modified Coronas Classification System: Type I – Two pronounced seasons: Dry from November to April, wet during the rest of the year; Type II – No dry season with a very pronounced rainfall from November to April and wet during the rest of the year; Type III – Seasons are not very pronounced; relatively dry from November to April, wet during the rest of the year; Type IV – Rainfall is more or less evenly distributed through the year



- Central and eastern areas of Luzon, designated as a mix of climate type I, III, and IV characterized by approximately half the year experiencing a wet season and the other half a dry spell. These regions are anticipated to undergo heightened levels of precipitation (Boston Consulting Group, 2023).

Areas prone to decreased precipitation (lower average total rainfall compared to the baseline) include:

- Northeastern portions of Luzon and southern areas of Mindanao encompassing areas classified as either Type III or IV with moderately pronounced and evenly distributed rainfall. These regions are forecasted to witness an overall decrease in total precipitation (Boston Consulting Group, 2023).

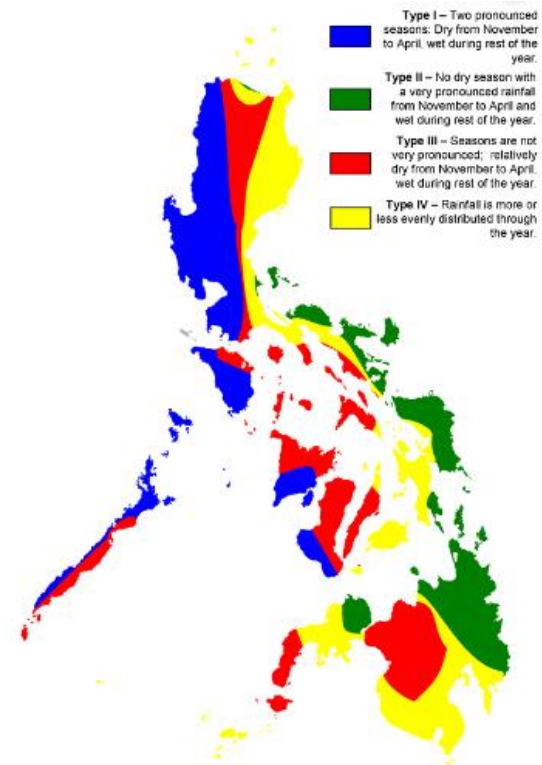


Figure 3.3.3.3: Four climate types of the Philippines based on Modified Coronas Classification System

Source: Oscar M. Lopez Center for Climate Change Adaptation and Disaster Risk Management Foundation, Inc. (Oscar M. Lopez Center) and Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), 2023. *State of the 2020 Philippine Climate, January 2023*

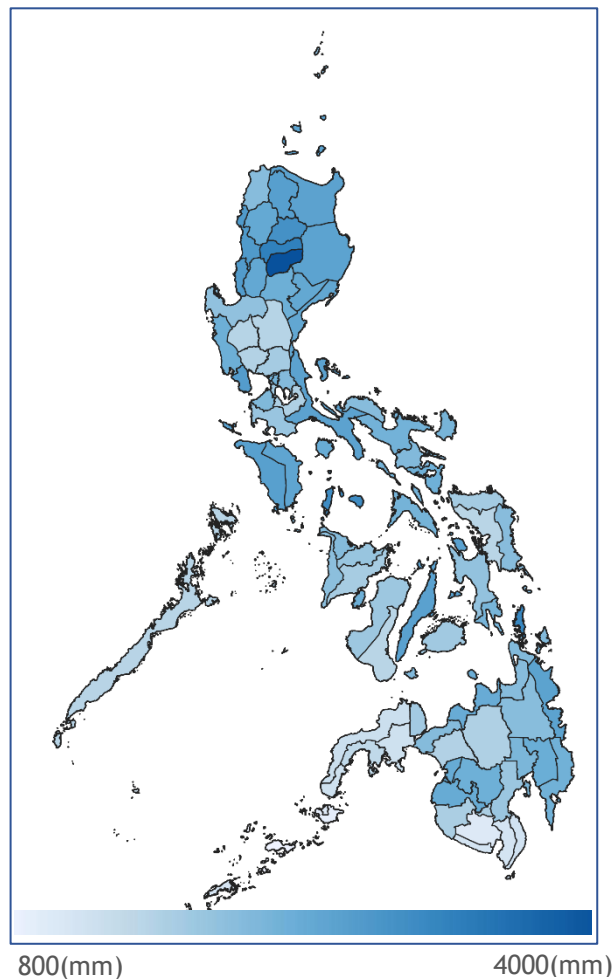


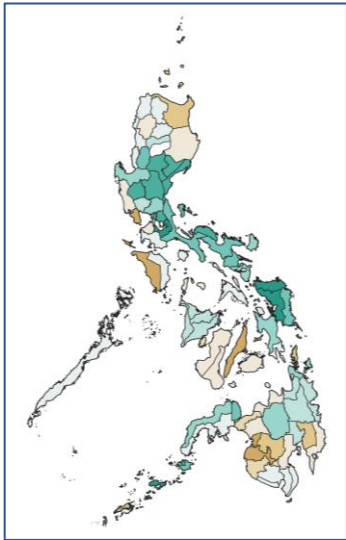
Figure 3.3.3.4: Historical annual precipitation in the Philippines (mm) from 1991-2020

Note: The methodology employs 30-year baselines for historical variability when possible. In cases with only a decade of data available, 10-year baselines are used, maintaining forecast consistency with 10-year ranges.

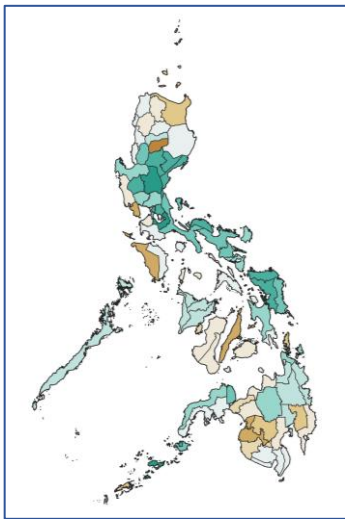
Data source: Boston Consulting Group. (2023). Data Model on Extreme Precipitation [Data model]. Retrieved from CMIP6 (Coupled Model Intercomparison Project Phase 6) database.



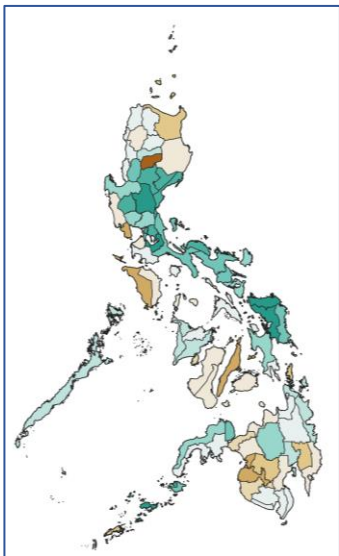
2030 – SSP2-4.5



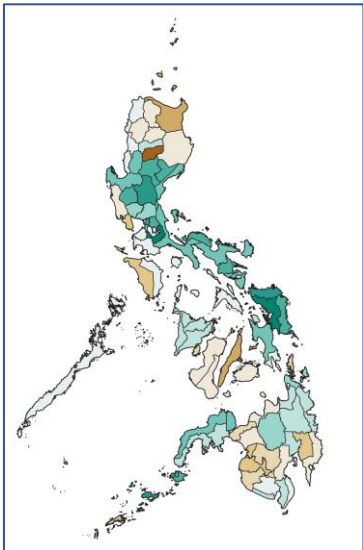
2030 – SSP5-8.5



2050 – SSP2-4.5



2050 – SSP5-8.5



-810(mm)

0

1500(mm)



Figure 3.3.3.5: Projected annual accumulated precipitation changes in the Philippines (mm) in 2030 (2021-2040) and 2050 (2041-2060) decades across SSP2-4.5 and SSP5-8.5 scenarios

Note: The methodology employs 30-year baselines for historical variability when possible. In cases with only a decade of data available, 10-year baselines are used, maintaining forecast consistency with 10-year ranges.

Data source: Boston Consulting Group. (2023). Data Model on Extreme Precipitation [Data model]. Retrieved from CMIP6 (Coupled Model Intercomparison Project Phase 6) database.

Increasing overall precipitation by 2030 and 2050, with drier dry seasons expected by 2050

With projected variability in annual precipitation comes varying distribution of precipitation across seasons, potentially impacting water resource management, agriculture, and ecosystems that rely on seasonal precipitation patterns.

By 2030 (2021-2040 annualized average), the projections suggest an overall increase in precipitation all year round, with the highest projected increase projected to happen in September-October-November (Boston Consulting Group, 2023).

Increasing trend in rainfall is observed pronouncedly over the eastern sections of Visayas and southeast areas of Luzon in December-January-February (corresponding to the northeast monsoon) in both 2030 and 2050. During March-April-May, or the driest period in the country, the northern and western sections of the country are projected to experience a noticeable drying trend by 2050. In June-July-August, concentrated precipitation increases in central areas of Luzon, western Visayas, and western Mindanao are projected (corresponding to the southeast monsoon), while a decreasing trend is found in the rest of the country. An increase trend is found mostly in the eastern regions and southwestern regions of the country in September-October-November (Boston Consulting Group, 2023).

Quarter	1991-2020 average precipitation (mm)	2021-2040 average precipitation (mm) (% change vs. baseline)		2041-2060 average precipitation (mm)	
		SSP2-4.5	SSP5-8.5	SSP2-4.5	SSP5-8.5
December-January-February	360	393 (+9%)	382 (+6%)	385 (+7%)	415 (+15%)
March-April-May	300	339 (+13%)	326 (+9%)	275 (-8%)	292 (-3%)
June-July-August	792	885 (+12%)	886 (+12%)	923 (+17%)	950 (+20%)
September-October-November	576	800 (+39%)	821 (+43%)	830 (+44%)	800 (+39%)

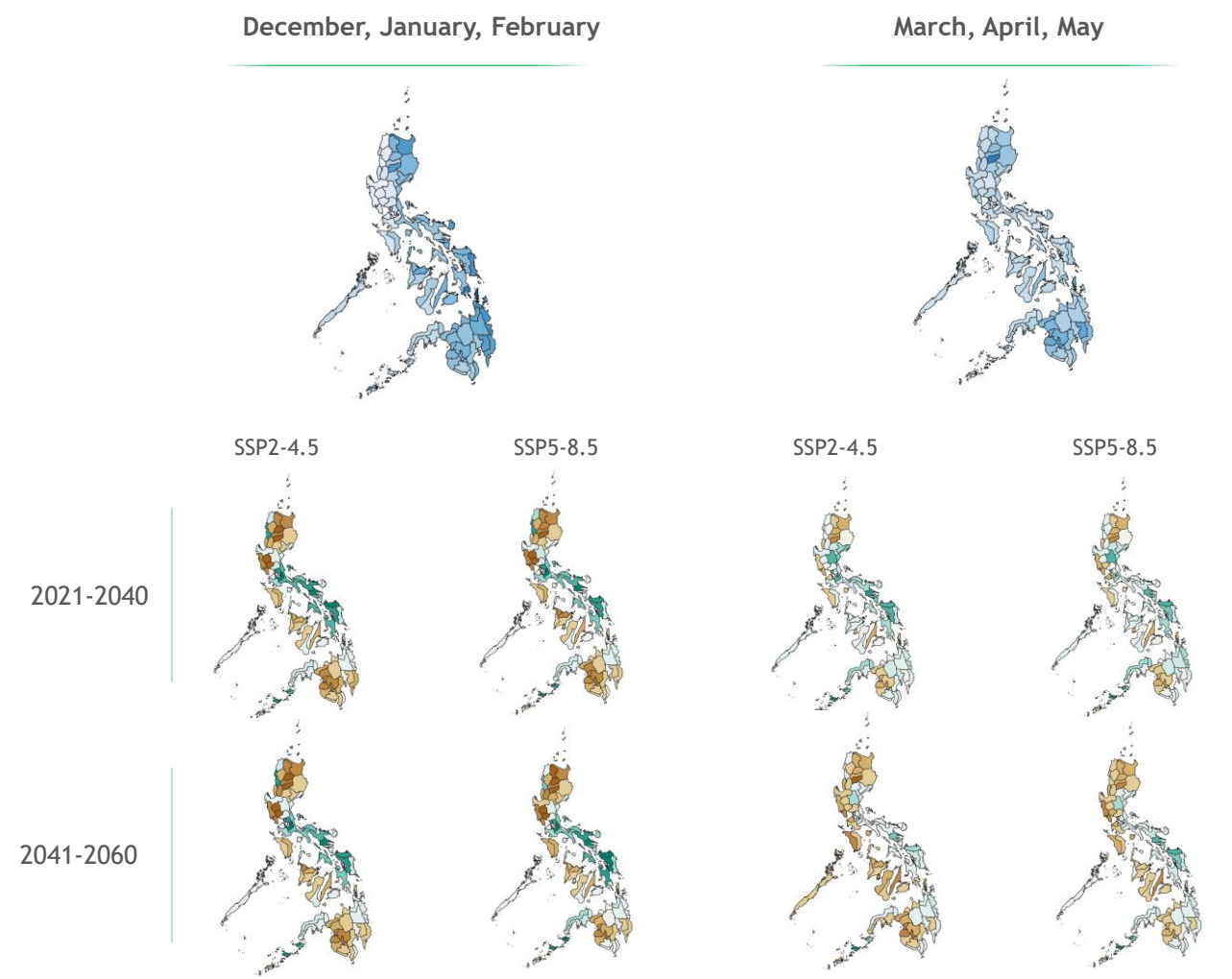


Total	2,028	2,417 (+19%)	2,415 (+19%)	2,413 (+19%)	2,457 (+21%)

Table 3.3.3.1: Quarterly historical (1991-2020) and projected precipitation in the Philippines (mm) across SSP2-4.5 and SSP5-8.5 scenarios in 2030 (2021-2040) and 2050 (2041-2060);

Note: The methodology employs 30-year baselines for historical variability when possible. In cases with only a decade of data available, 10-year baselines are used, maintaining forecast consistency with 10-year ranges.

Data source: Boston Consulting Group. (2023). Data Model on Extreme Precipitation [Data model]. Retrieved from CMIP6 (Coupled Model Intercomparison Project Phase 6) database.



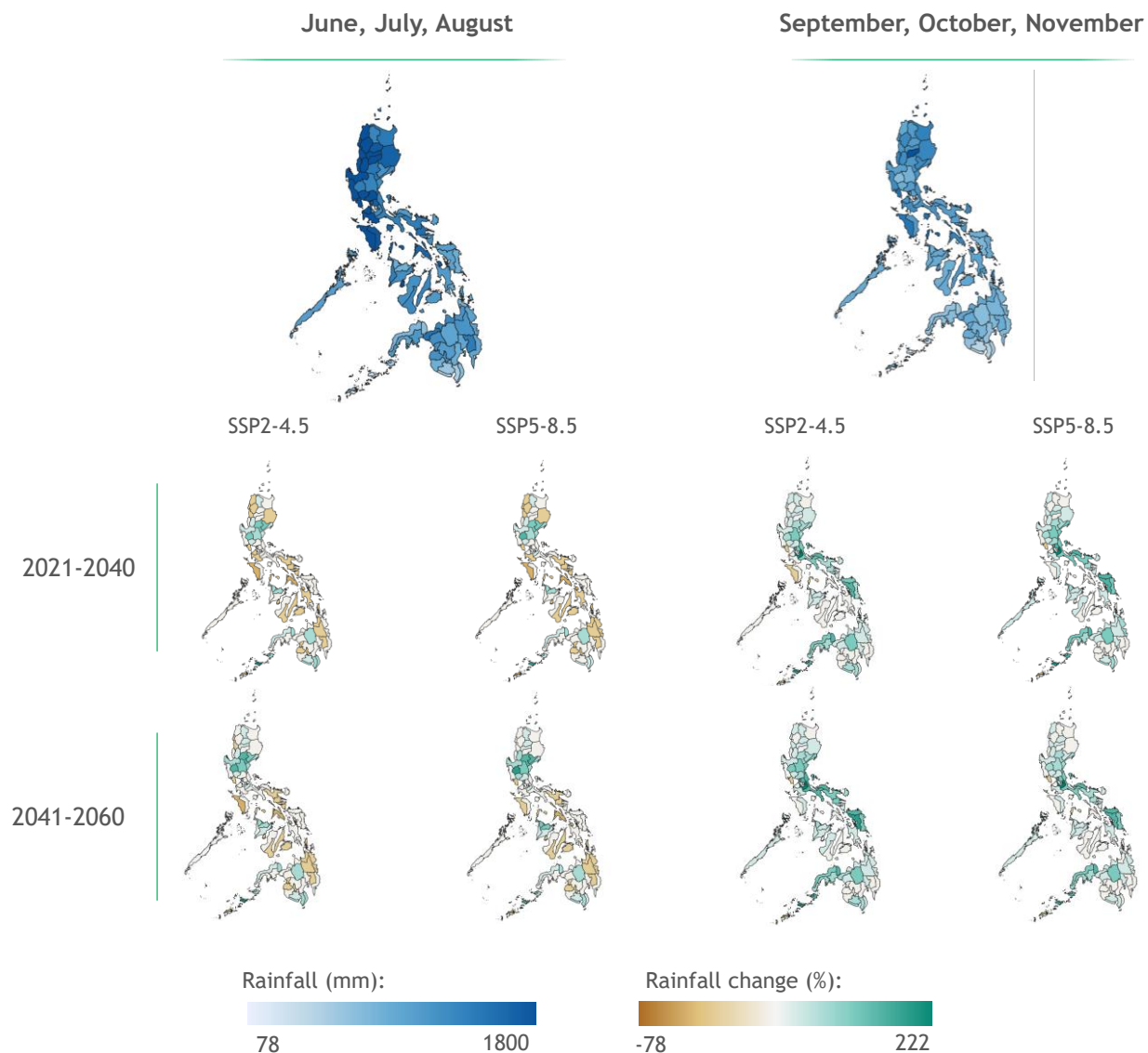


Figure 3.3.3.6: Seasonal and spatial historical (1991-2020) and projected precipitation in the Philippines (mm) across SSP2-4.5 and SSP5-8.5 scenarios in 2030 (2021-2040) and 2050 (2041-2060);

Note: The methodology employs 30-year baselines for historical variability when possible. In cases with only a decade of data available, 10-year baselines are used, maintaining forecast consistency with 10-year ranges.

Data source: Boston Consulting Group. (2023). Data Model on Extreme Precipitation [Data model]. Retrieved from CMIP6 (Coupled Model Intercomparison Project Phase 6) database.



Potential socio-economic impact

Key takeaways

Pluvial flooding

- About 5 million Filipinos affected, with economic losses of about PHP 275 to 300 billion due to pluvial flooding by in the near term (2020-2040 annualized average) and long term (2040-2060 annualized average) (Boston Consulting Group, 2023).

Fluvial flooding

- About 250K and 300K Filipinos exposed, with potential economic losses of about PHP 13 to 16 billion due to fluvial flooding in the near term (2020-2040 annualized average) and long term (2040-2060 annualized average) (Boston Consulting Group, 2023).

Landslides

- Approximately 2 million of Filipinos may face exposure to at least one significant rain-induced landslide⁷⁸ event per decade (Boston Consulting Group, 2023).

Socioeconomic Impact: Pluvial flooding	2020-2040 annualized average		2040-2060 annualized average	
	SSP2-4.5	SSP5-8.5	SSP2-4.5	SSP5-8.5
Social impact: Population exposed	2.3 Mn to 4.8 Mn	2.3 Mn to 4.8 Mn	2.4 Mn to 5.1 Mn	2.5 Mn to 5.2 Mn
Economic Impact: Infrastructure damage (PHP)	273 Bn	274 Bn	285 Bn	296 Bn

Socioeconomic Impact: Fluvial flooding	2020-2040 annualized average		2040-2060 annualized average	
	SSP2-4.5	SSP5-8.5	SSP2-4.5	SSP5-8.5

⁷⁸ Landslide is the movement of a mass of rock, earth, or debris down a slope, with the qualification that landslides are not confined to the land, nor to simple sliding failure. Landslides can encompass falls, flows, topples and spreads in addition to slides



Social impact: Population exposed	177 K to 250 K	179 K to 254 K	200 K to 280 K	216 K to 297 K
Economic Impact: Infrastructure damage (PHP)	13 Bn	13 Bn	15 Bn	16 Bn

Table 3.3.3.2: Social and economic impact of pluvial and fluvial flooding

Note: Figures provided are approximations; Population impacted by pluvial and fluvial floods: defined as the population located in an area flooding with at least 30-60cm flooding depth (lower bound figure represents 60cm, higher bound figure represents 30cm flooding); Assumes 1 in 10 year return period

Data source: Boston Consulting Group. (2023). Data Model on Extreme Precipitation [Data model]. Retrieved from CMIP6 (Coupled Model Intercomparison Project Phase 6) database. Boston Consulting Group. (2023). Data Model on Pluvial and Fluvial Flooding [Data model]. Retrieved from Fathom Global release 3.0 database.

Pluvial and fluvial floods are two types of floods that occur in response to extreme precipitation events. Pluvial flooding refers to the inundation of land and urban areas caused by heavy precipitation, where the excess water cannot be efficiently absorbed or drained due to factors such as impermeable surfaces and inadequate drainage systems. On the other hand, fluvial flooding occurs when rivers and streams exceed their capacity and overflow their banks due to intense or prolonged precipitation.

Pluvial and fluvial flooding predictions are generated using hydraulic models based on shallow water equations. These models account for variables like water height, flow dynamics, and coastal topography.

About 5 million Filipinos affected, with economic losses of about PHP 275 to 300 billion due to pluvial flooding in the near and long term⁷⁹

Overall, pluvial floods, or flooding that happens due to excessive precipitation overwhelming the local drainage capacity, result in the disruption of approximately 4.8 million individuals in the near term (2020-2040 annualized average) and 5.2 million individuals in the long term (2040-2060 annualized average) (SSP5-8.5 scenario), defined as the population located in an area flooding with at least 30cm flooding depth (Boston Consulting Group, 2023).

Pluvial flooding is forecasted to cause up to PHP 274 Bn in infrastructure damage in the near term and nearly PHP 300 Bn in the long term, representing the largest contributor to infrastructure among the key climatic-impact drivers (Boston Consulting Group, 2023).

⁷⁹ Methodology provided in appendix.



About 250K and 300K Filipinos exposed, with potential economic losses of about PHP 13 to 16 billion due to fluvial flooding in the near and long term⁸⁰

The number of Filipinos potentially impacted by fluvial floods, or flooding that occurs as a result of the overflowing of rivers and streams, is projected to reach 254,000 in the near term and reaching 297,000 Filipinos impacted by fluvial floods with at least 30cm flooding depth in the long term (SSP5-8.5 scenario) (Boston Consulting Group, 2023). Damage to infrastructure caused by fluvial flooding is projected to reach PHP13 Bn in the near term and PHP16 Bn in the long term (Boston Consulting Group, 2023).

Increased precipitation intensity raises landslide occurrence, potentially affecting 2 million of Filipinos⁸¹

Rain-induced landslides⁸² are another significant concern associated with extreme precipitation events. Understanding the occurrence and characteristics of pluvial and fluvial floods and landslides allows one to assess the vulnerability of different regions to extreme precipitation events.

Through initial analysis, it has been determined that, on average, approximately every 5 years, 1.1% of the population and 1.6% of the Philippine territory may face exposure to at least one significant landslide event (Boston Consulting Group, 2023). Over the span of a decade, these numbers increase to 1.8% of the total population (2 million individuals) and 3% of the total area potentially exposed (Boston Consulting Group, 2023).

When considering a longer timeframe, such as a 100-year return period, the exposure of the Philippine territory escalates to 9%, while the population exposure rises to 18% (Boston Consulting Group, 2023). This highlights the increasing vulnerability to landslides over time.

⁸⁰ Methodology provided in appendix.

⁸¹ Methodology provided in appendix ; Economic damages from landslides not calculated due to data availability

⁸² Significant landslides are those which are likely to have been reported had they occurred in a populated place. Landslide as defined by *Cruden (1991) - the movement of a mass of rock, earth or debris down a slope, with the qualification that landslides are not confined to the land, nor to simple sliding failure.*

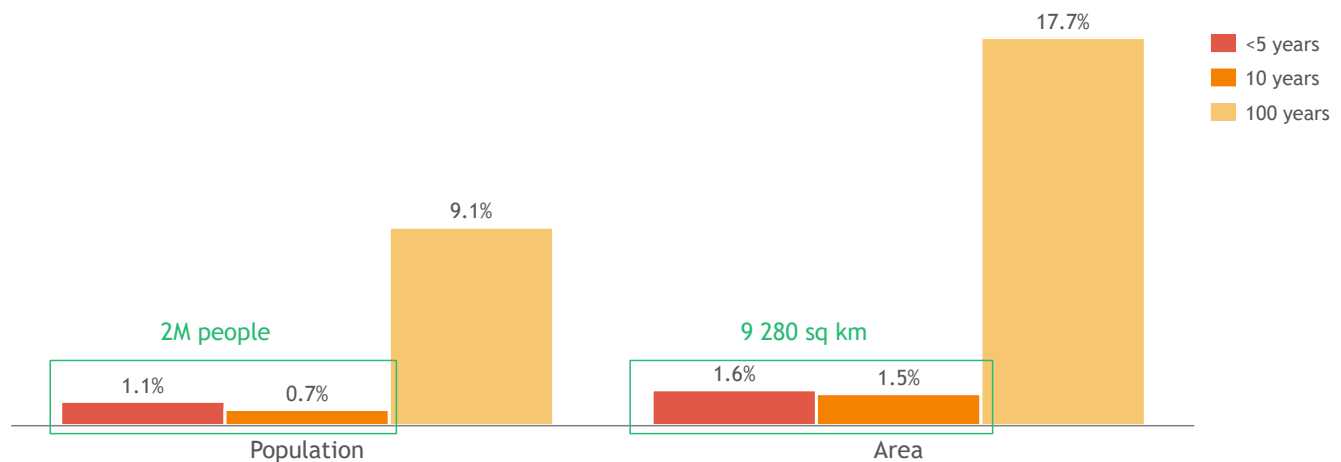


Figure 3.3.3.7: Population and Area exposed to landslide occurrence for 5-, 10-, and 100- year return periods

Note: Population impacted if less than 500m away from area with an average projected landslide occurrence in 10-year period that is > 0%

Data source: Boston Consulting Group. (2023). Data Model on Landslides [Data model]. Retrieved from Global Landslide Hazard map – precipitation trigger from the World Bank, NASA Global Landslide Catalogue, NASA Global Susceptibility Map, NOAA CPC Precipitation Data, and WorldPop population databases.

Most impacted regions

Key takeaways

Pluvial flooding

- Regions in Luzon are projected to face the highest pluvial flooding depths and overall population impact, while Visayas regions must prepare for escalating pluvial flooding threats and adapt accordingly (Boston Consulting Group, 2023).
- CAR, Region IV-B (MIMAROPA), and Region II (Cagayan Valley) in Luzon are projected to experience the highest average and maximum flooding depths by 2030 (2020-2040 annualized average) under SSP5-8.5 scenario (Boston Consulting Group, 2023).
- Regions IV-A (CALABARZON) and III (Central Luzon) in Luzon, are projected to experience the highest number of people impacted by pluvial flooding by 2030 (SSP5-8.5 scenario), with up to 880,000 and 520,000 individuals, respectively (Boston Consulting Group, 2023).
- Regions IV-A (CALABARZON), III (Central Luzon), and V (Bicol Region) in Luzon are projected to account for 40% (PHP110 out of PHP274 Bn) of the total projected infrastructure damage from pluvial flooding in the country by 2030 under SSP5-8.5 (Boston Consulting Group, 2023).

Fluvial flooding

- Fluvial flood risk remains persistent in Mindanao regions, namely regions XII (SOCCSKSARGEN), X (Northern Mindanao), and XI (Davao Region), and emerging



vulnerability in regions IX (Zamboanga Peninsula), VIII (Eastern Visayas), and VII (Central Visayas) (Boston Consulting Group, 2023).

- Projections indicate substantial increases in average flooding depth for regions IX (Zamboanga Peninsula), VIII (Eastern Visayas), and VII (Central Visayas) compared to the historical baseline, with projected increases of 68%, 31%, and 30% respectively (Boston Consulting Group, 2023).
- Regions I, II, and III are projected to bear the brunt of fluvial flooding impacts, with the highest number of people affected, totaling up to 130,000 individuals, and the most significant infrastructure damage, reaching up to PHP 6 billion, which constitutes a substantial 47% share of the total fluvial infrastructure damage in 2030 (Boston Consulting Group, 2023).

Landslides

- Benguet, La Union, and Ilocos Sur provinces most susceptible to occurrence of landslides in a 10-year return period with a respective 30%, 21%, and 18% projected occurrence in a 10-year return period (Boston Consulting Group, 2023).

Regions in Luzon are projected to face the highest pluvial flooding depths and overall population and economic impact

The regions in Luzon, especially the Cordillera Administrative Region (CAR), have long been prone to high pluvial flooding depths, and this susceptibility is expected to persist in the coming decades (Boston Consulting Group, 2023). Projections indicate a potential increase of up to 20% in average pluvial flooding heights by 2050 (see to Figure 3.3.3.8) (Boston Consulting Group, 2023). Among these regions, CAR, Region IV-B (MIMAROPA), and Region II (Cagayan Valley) stand out as areas with the highest average and maximum flooding heights anticipated by 2030 under the SSP5-8.5 scenario (see Table 3.3.3.3) (Boston Consulting Group, 2023).

Additionally, regions in Luzon, particularly regions IV-A (Calabarzon) and III (Central Luzon), are expected to experience the highest number of people impacted by pluvial flooding by 2030 (SSP5-8.5 scenario), with approximately up to 880,000 and 520,000 individuals, respectively (Boston Consulting Group, 2023). For the purposes of this assessment, the population impacted is defined as people located in an area flooded with at least 30-60cm of water (30cm as the upper range of the number of people impacted).

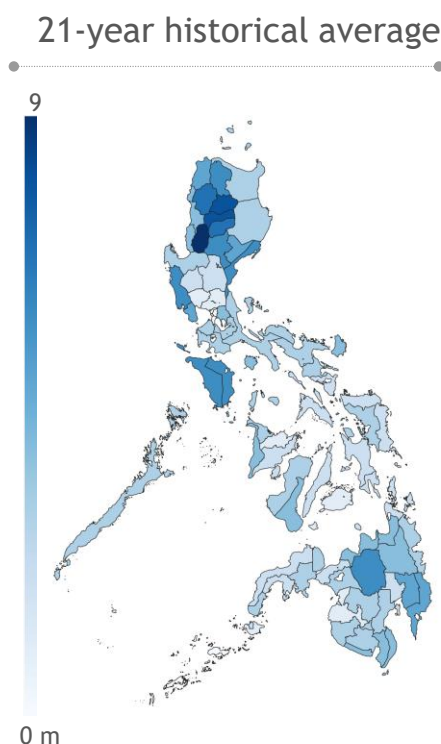
While Luzon regions will be significantly impacted by pluvial floods, Visayas regions, particularly Regions VIII (Eastern Visayas) and VII (Central Visayas), are projected to undergo the highest change (~3%) in average flooding by 2030 (SSP5-8.5 scenario), underscoring the need for additional adaptation efforts in those areas (Boston Consulting Group, 2023).

The spatial pattern of pluvial flooding aligns with the regions' susceptibility, as Luzon historically experiences the most extensive flooding. This is measured by the area within a location with flooding with at least 30cm-60cm of water. Regions II and III are expected to have the largest affected areas



in square meters, along with notable percentage changes by 2030 compared to historical baseline (see Table 3.3.3.3) (Boston Consulting Group, 2023).

In terms of economic impact from pluvial flooding damages to infrastructure, regions IV-A, III, and V (Bicol Region) in Luzon are expected to incur up to PHP 56 Bn, PHP 33 Bn, and PHP 21 Bn, respectively. These three regions collectively account for 40% (PHP 110 Bn out of PHP 274 Bn) of the total projected infrastructure damage in the country by 2030 under SSP5-8.5 (Boston Consulting Group, 2023).



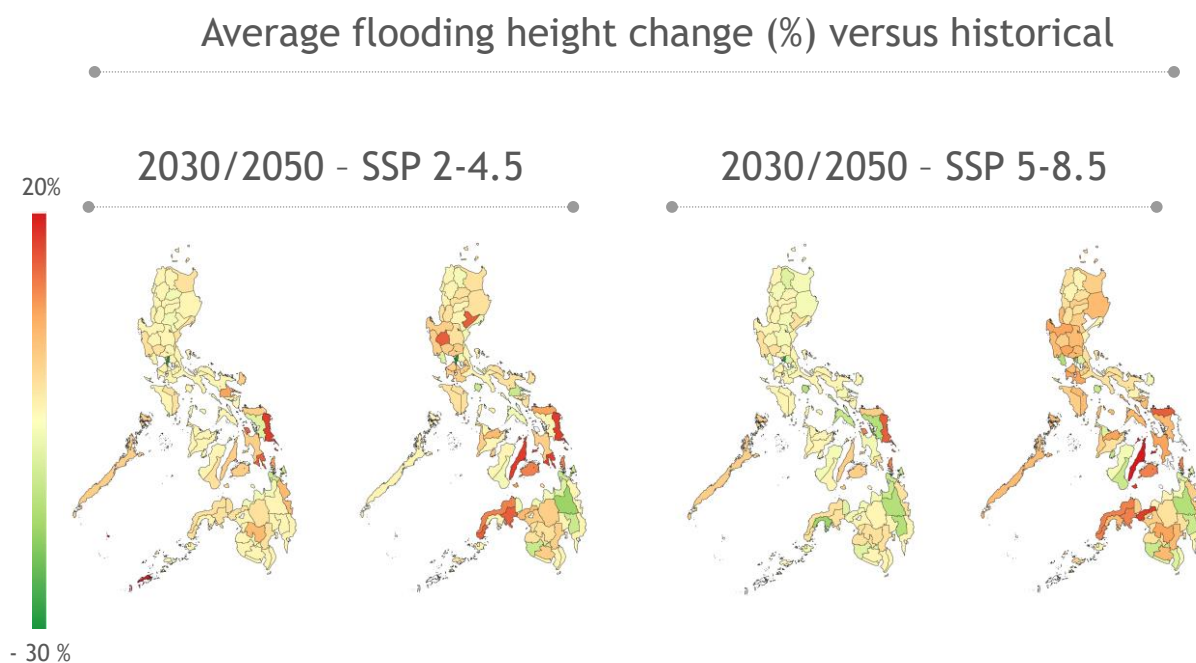


Figure 3.3.3.8: Map of 21-year historical average pluvial flooding height (meters) and projected 2030 (2020-2040) and 2050 (2040-2060) pluvial flooding height change (%) in a 10-year return period

Note: Historical figure is limited based on river and rain gauge availability within any historical 21-year period (treated as an uncertain variable); Flooding height change in 2030 (2020-2040) and 2050 (2040-2060) compared to 21-year baseline

Data source: Boston Consulting Group. (2023). Data Model on Pluvial and Fluvial Flooding [Data model]. Retrieved from Fathom Global release 3.0 database. Note: Incorporates precipitation from tropical cyclones in pluvial and fluvial flood maps

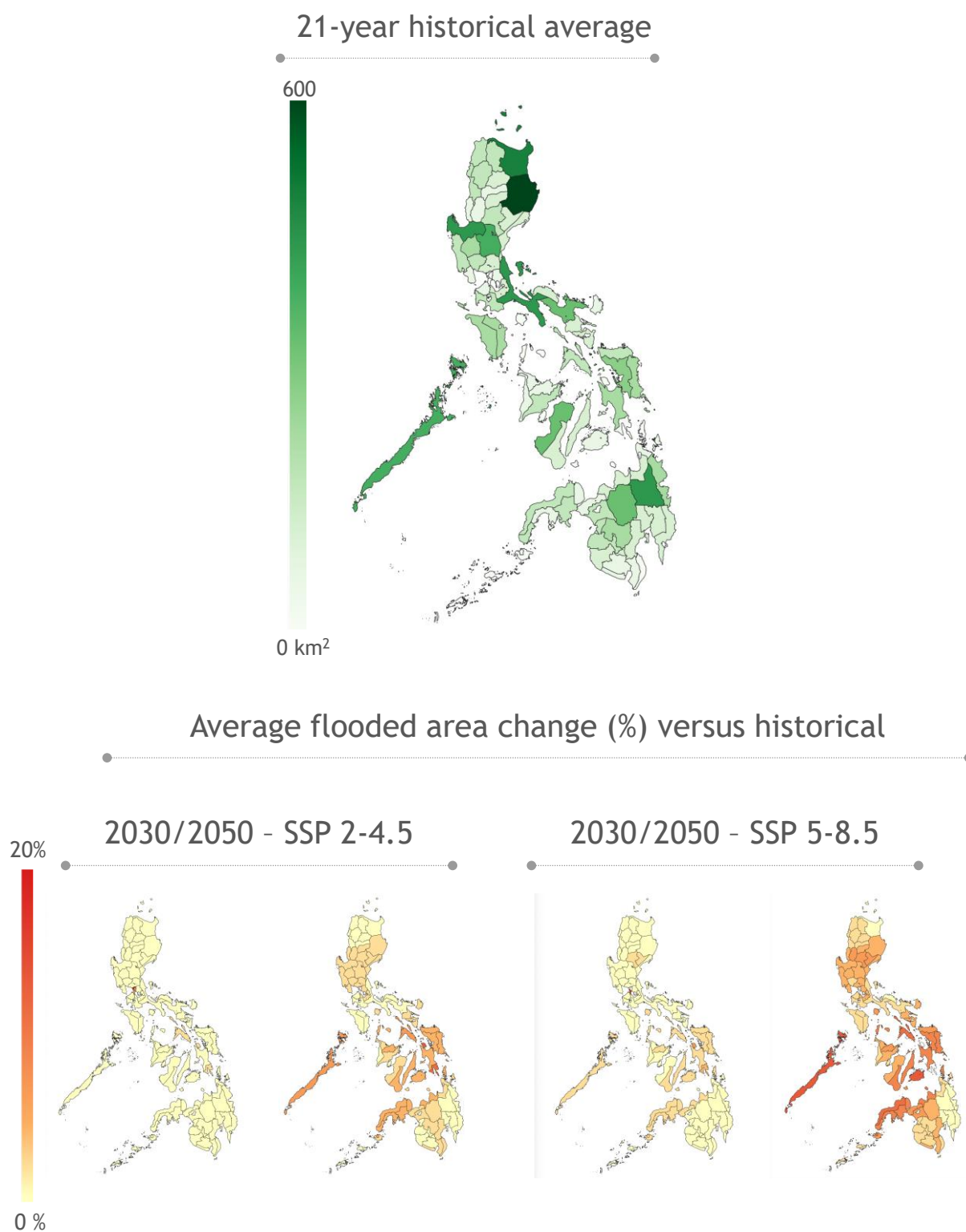


Figure 3.3.3.9: Map of 21-year historical area impacted from pluvial flooding (square kilometers) and projected 2030 (2020-2040) and 2050 (2040-2060) pluvial flooding height change (%) in a 10-year return period



Note: Historical figure is limited based on river and rain gauge availability within any historical 21-year period (treated as an uncertain variable); Area impacted defined as located in area flooding with at least 30cm-60cm of water

Data source: Boston Consulting Group. (2023). Data Model on Pluvial and Fluvial Flooding [Data model]. Retrieved from Fathom Global release 3.0 database. Note: Incorporates precipitation from tropical cyclones in pluvial and fluvial flood maps



Region	Average flooding (meters)	Average flooding % change vs. historical	Pop. Impacted (k people)	% of total population impacted (2020 population)	Area Impacted (sq km)	Area Impacted % change vs. 2020	Economic impact (PHP Bn)
Cordillera Administrative Region	7.9	0%	110-140	6-8%	759	1%	7
Region IV-B	4.6	2%	70-150	2-5%	922	2%	10
Region II	4.3	0%	110-220	3-6%	1379	1%	13
Region I	4.2	1%	150-300	3-6%	872	1%	18
Region X	4.2	0%	160-320	3-6%	621	2%	13
Region XI	4.0	-1%	70-170	1-3%	516	1%	11
Region XII	3.7	1%	60-170	1-3%	523	1%	10
Region XIII	3.6	-2%	50-130	2-5%	868	1%	8
Region V	3.6	0%	210-410	3-7%	937	2%	21
Region IV-A	3.6	0%	480-880	3-6%	868	1%	56
Region III	3.4	1%	220-520	2-4%	1358	1%	33
Region VI	3.1	0%	170-410	2-5%	815	2%	21
Region VIII	2.8	3%	110-280	2-6%	1032	3%	16
Region IX	2.8	1%	80-200	2-5%	453	3%	8
Region VII	2.2	3%	130-320	2-4%	363	3%	18



Bangsamoro Autonomous Region in Muslim Mindanao	2.1	2%	80-160	2-4%	433	1%	7
National Capital Region	0.4	-27%	20-50	0-0%	5	21%	4

Top metrics under each category

Table 3.3.3.3: Average depth of areas flooded (meters) due to pluvial flooding, percent change in region average flooding versus 21-historical baseline, population impacted (range of 30-60cm of flooding), percent of total population impacted using 2020 population figures, area impacted, change in region area impacted versus 21-year historical baseline, and economic impact (infrastructure damage) under SSP5-8.5 scenario by 2030 in a 10-year return period.

Note: Table sorted based on average flooding (meters). Figures in highlight top figures under respective metrics; Figures are approximations; Population impacted rounded; Population and area impacted defined as population or area located in area flooding with at least 30cm-60cm of water (table excludes regions that do not meet parameters)

Note: Historical figure is limited based on river and rain gauge availability within any historical 21-year period (treated as an uncertain variable); Area impacted defined as located in area flooding with at least 30cm-60cm of water

Data source: Boston Consulting Group. (2023). Data Model on Pluvial and Fluvial Flooding [Data model]. Retrieved from Fathom Global release 3.0 database. Note: Incorporates precipitation from tropical cyclones in pluvial and fluvial flood maps



Persistent fluvial flood risk in Mindanao regions, particularly regions XII (SOCCSKSARGEN), X (Northern Mindanao), and XI (Davao Region), and emerging vulnerability in regions IX (Zamboanga Peninsula), VIII (Eastern Visayas), and VII (Central Visayas)

Fluvial floods have historically been prevalent in Mindanao regions due to the presence of several river basins in the area, including the Mindanao, Agusan, Tagum-Libuganon, Davao, Agus, Cagayan De Oro, Tagoloan, and Buayan basins, among others (PAGASA, 2023).

Projections indicate that Mindanao regions will continue to face significant fluvial flood challenges, with the highest levels of average flooding found in regions XII (SOCCSKSARGEN), X (Northern Mindanao), and XI (Davao Region) in Mindanao, where average fluvial flooding depths are expected to reach between 4-5 meters by 2030 (SSU5-8.5 scenario) (see Table 3.3.3.4) (Boston Consulting Group, 2023).

However, it is crucial to highlight the growing vulnerability of regions IX (Zamboanga Peninsula), VIII (Eastern Visayas), and VII (Central Visayas), as these regions are projected to experience the largest increase in average flooding, emphasizing the need for robust preparedness and resilience strategies to address the potential impacts of fluvial flooding in the coming decades (see Figure 3.3.3.10 and Table 3.3.3.4) (Boston Consulting Group, 2023).

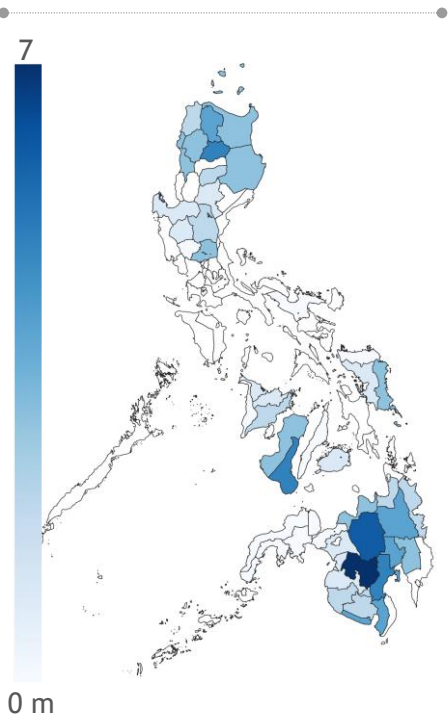
Luzon Regions I (Ilocos region), II (Cagayan Valley), and III (Central Luzon) are expected to have the highest population exposure to fluvial floods and the most significant infrastructure damages.

While the average flooding depth is projected to increase most significantly in certain regions of Mindanao, the socioeconomic impact of fluvial flooding is most pronounced in Regions I (Ilocos Region), II (Cagayan Valley), and III (Central Luzon) in Luzon. These regions bear the heaviest burden, with up to 130k people impacted and PHP 6Bn in damages, accounting for 47% of the total fluvial infrastructure damage (PHP 6bn of 13Bn) in 2030 under the SSP5-8.5 scenario (Boston Consulting Group, 2023).

By recognizing the unique challenges faced by the Mindanao regions, as well as the emerging vulnerabilities in regions IX (Zamboanga Peninsula), VIII (Eastern Visayas), and VII (Central Visayas), and the socioeconomic impact in regions I (Ilocos Region), II (Cagayan Valley), and III (Central Luzon), stakeholders can develop targeted strategies to enhance resilience, reduce risks, and protect communities from the devastating impacts of fluvial flooding in the years to come.



21-year historical average



Average flooding height change (%) versus historical

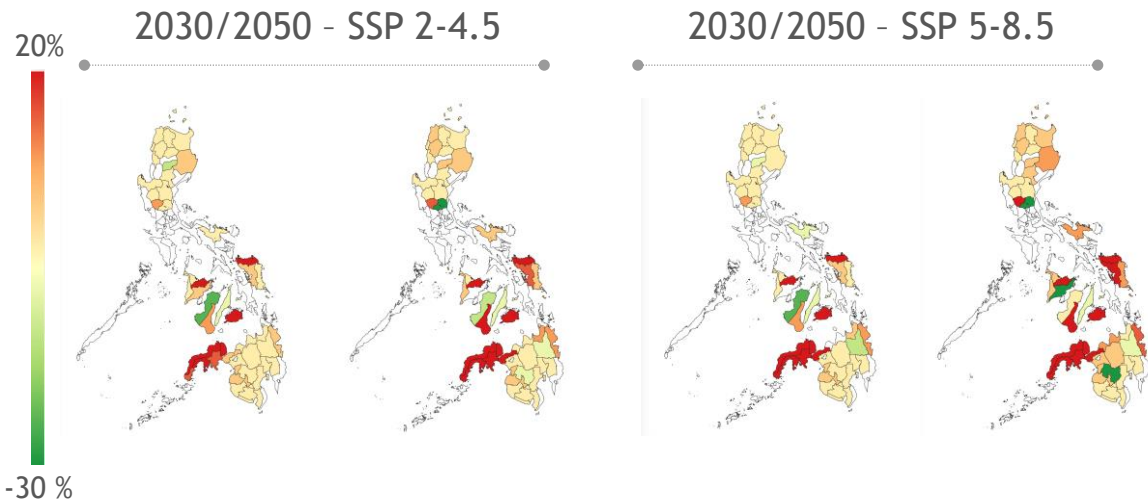
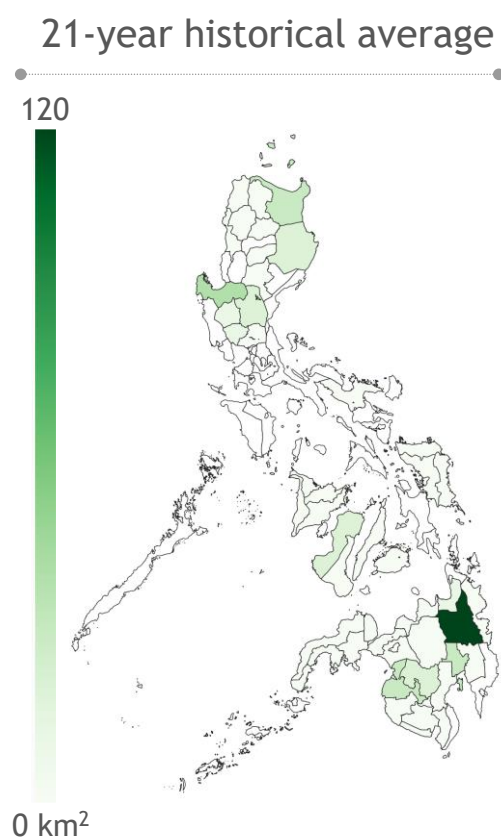




Figure 3.3.3.10: Map of 21-year historical average fluvial flooding height (meters) and projected 2030 (2020-2040) and 2050 (2040-2060) pluvial flooding height change (%) in a 10-year return period

Note: Historical figure is limited based on river and rain gauge availability within any historical 21-year period (treated as an uncertain variable); Flooding height change in 2030 (2020-2040) and 2050 (2040-2060) compared to 21-year baseline

Data source: Boston Consulting Group. (2023). Data Model on Pluvial and Fluvial Flooding [Data model]. Retrieved from Fathom Global release 3.0 database. Note: Incorporates precipitation from tropical cyclones in pluvial and fluvial flood maps



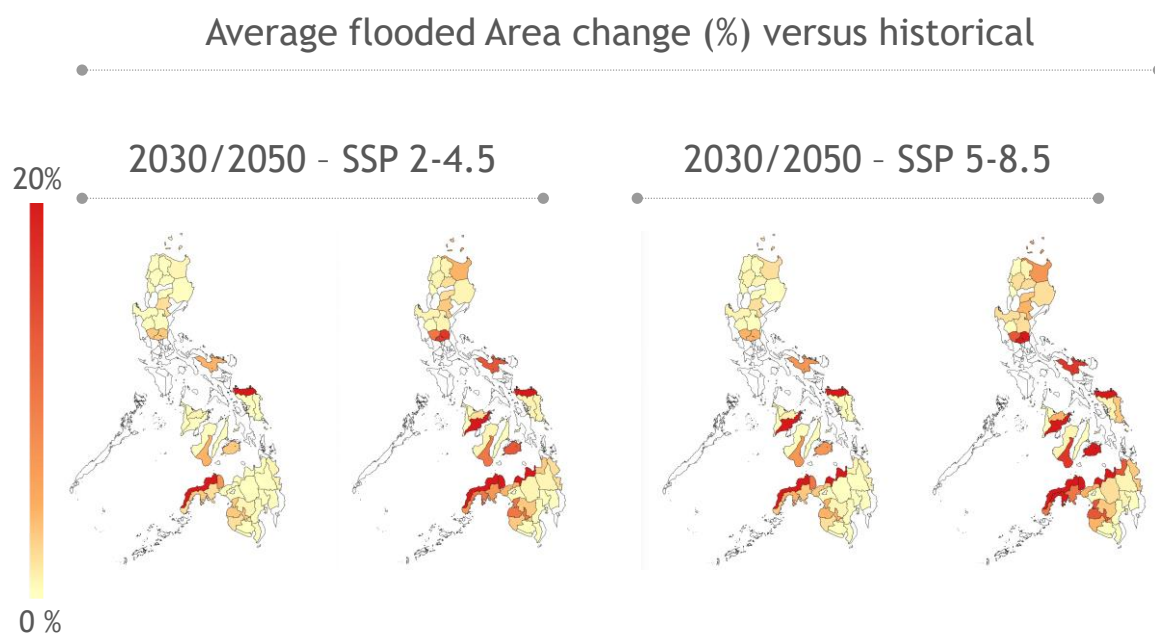


Figure 3.3.3.11: Map of 21-year historical area impacted from fluvial flooding (square kilometers) and projected 2030 (2020-2040) and 2050 (2040-2060) pluvial flooding height change (%) in a 10-year return period

Note: Historical figure is limited based on river and rain gauge availability within any historical 21-year period (treated as an uncertain variable); Area impacted defined as located in area flooding with at least 30cm-60cm of water

Data source: Boston Consulting Group. (2023). Data Model on Pluvial and Fluvial Flooding [Data model]. Retrieved from Fathom Global release 3.0 database. Note: Incorporates precipitation from tropical cyclones in pluvial and fluvial flood maps



Region	Average flooding (meters)	Average flooding % change vs. 2020	Pop. Impacted (k people)	% of total pop. impacted (2020 pop.)	Area Impacted (sq km)	Area Impacted % change vs. 2020	Economic impact (PHP Bn)
Region XII	4.8	4%	10-20	0-0%	44	16%	1
Region X	4.5	-5%	10-20	0-0%	15	18%	1
Region XI	4.4	2%	10-20	0-0%	53	4%	1
Region XIII	3.9	-1%	20-30	1-1%	155	7%	2
Region VII	3.8	30%	3-3	0-0%	1	42%	0
Cordillera Administrative Region	3.8	0%	10-10	0-0%	24	9%	0
Region II	3.6	4%	40-50	1-1%	82	18%	2
Region I	2.1	2%	20-30	0-0%	54	12%	2
Region III	2.1	1%	30-50	0-0%	62	17%	2
Region VIII	1.8	31%	3-5	0-0%	14	15%	0
Region VI	1.7	-18%	20-20	0-0%	44	13%	1
Bangsamoro Autonomous Region in Muslim Mindanao	1.1	6%	5-10	0-0%	51	37%	1
Region IX	0.9	68%	2-2	0-0%	11	41%	0
Region V	0.5	-2%	1-1	0-0%	2	52%	0

Top metrics under each category



Table 3.3.3.4: Average depth of areas flooded (meters) due to fluvial flooding, percent change in region average flooding versus 21-historical baseline, population impacted (range of 30-60cm of flooding), percent of total population impacted using 2020 population figures, area impacted, change in region area impacted versus 21-year historical baseline, and economic impact (infrastructure damage) under SSP5-8.5 scenario by 2030 in a 10-year return period.

Note: Table sorted based on average flooding (meters). Figures in highlight top figures under respective metrics; Figures are approximations; Population impacted rounded; Population and area impacted defined as population or area located in area flooding with at least 30cm-60cm of water (table excludes regions that do not meet parameters)

Note: Historical figure is limited based on river and rain gauge availability within any historical 21-year period (treated as an uncertain variable); Area impacted defined as located in area flooding with at least 30cm-60cm of water

Data source: Boston Consulting Group. (2023). Data Model on Pluvial and Fluvial Flooding [Data model]. Retrieved from Fathom Global release 3.0 database. Note: Incorporates precipitation from tropical cyclones in pluvial and fluvial flood maps



Benguet, La Union, and Ilocos Sur provinces most susceptible to occurrence of landslides

Table 3.3.3.5 presents the provinces with the highest average projected occurrence to landslides, indicating notable occurrence potential in Benguet, La Union, and Ilocos Sur. These regions have consistently shown elevated levels of susceptibility to landslides based on historical data and the main drivers that contribute to such incidents. These drivers include factors such as vegetation cover, infrastructure development, slope steepness, and precipitation intensity.

It is also important to note that Benguet, La Union, and Pangasinan provinces are projected to have the greatest number of people impacted by landslide occurrence in a 10-year return period (Boston Consulting Group, 2023).

Region	Province	Average projected occurrence in a 10-year return period	Maximum projected occurrence in a 10-year return period	Pop. Impacted (k people) / % of total population (2020 population)	Area Impacted (sq km)
CAR	Benguet	30%	62%	0.83 (100%)	3 005 (100%)
Region I	La Union	21%	45%	0.63 (79%)	1 283 (86%)
Region I	Ilocos Sur	18%	52%	0.37 (55%)	2 092 (79%)
CAR	Abra	7%	27%	0.19 (74%)	3 695 (88%)
CAR	Mountain Prov.	7%	44%	0.12 (78%)	1 561 (69%)
CAR	Ifugao	4%	19%	0.13 (62%)	1 570 (59%)
Region I	Pangasinan	3%	48%	0.55 (18%)	2 229 (41%)
Region I	Ilocos Norte	3%	12%	0.23 (40%)	2 389 (68%)
Region II	Nueva Vizcaya	3%	21%	0.28 (55%)	2 888 (66%)
Region III	Zambales	3%	20%	0.57 (68%)	2 472 (63%)

Top metrics under each category

Table 3.3.3.5: Top 10 provinces with highest average projected occurrence of landslides in a 10-year return period, maximum projected occurrence of landslides in a 10-year return period, population impacted, population impacted, percent of total population impacted using 2020 population figures, area impacted, percent of total area impacted, and economic impact



Note: Table sorted based on projected occurrence - estimated annual frequency of significant landslides per square kilometer; Significant landslides are those which are likely to have been reported had they occurred in a populated place; Figures highlighted indicate top 3 figures under respective metrics; Population and area impacted defined as: population and area impacted if less than 500m away from area with an average projected landslide occurrence in 10-year period that is > 0%

Data Source: Boston Consulting Group. (2023). Data Model on Landslides [Data model]. Retrieved from Global Landslide Hazard map – precipitation trigger from the World Bank, NASA Global Landslide Catalogue, NASA Global Susceptibility Map, NOAA CPC Precipitation Data, and WorldPop population databases.

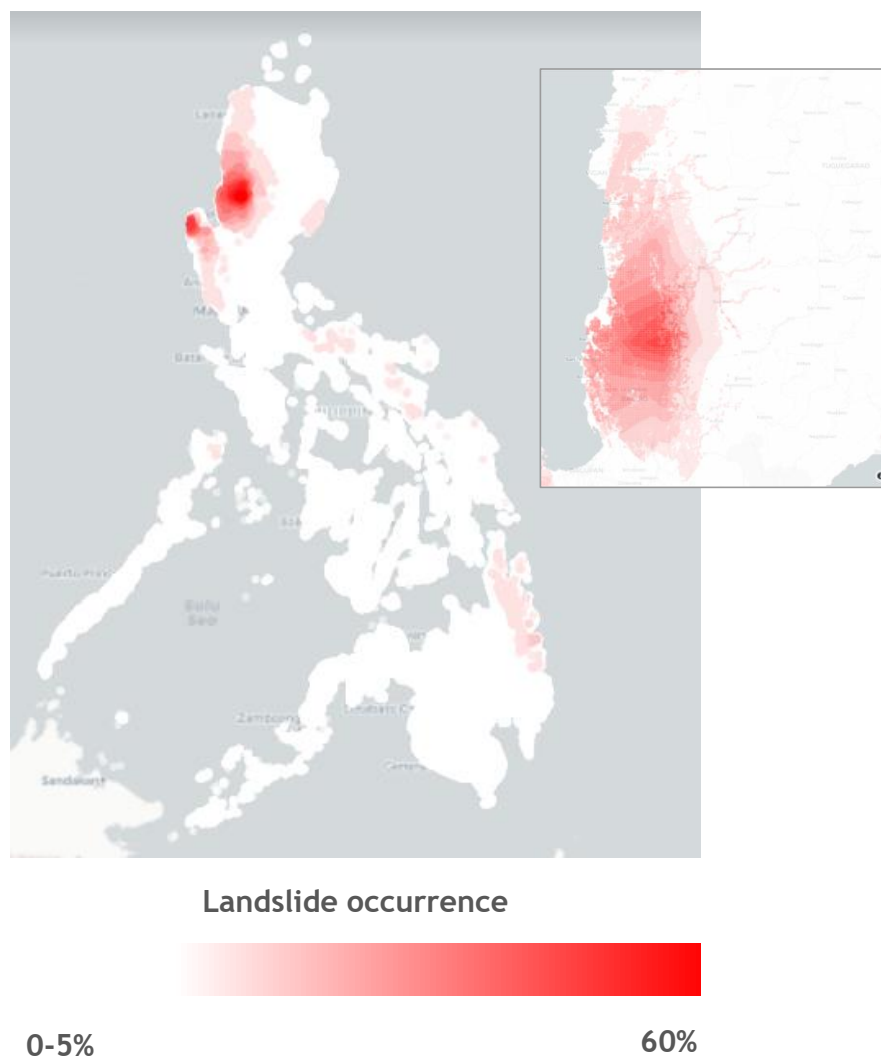


Figure 3.3.3.12: Map of average landslide occurrence in a 10-year return period (%)

Note: Projected occurrence - estimated annual frequency of significant landslides per square kilometer; Significant landslides are those which are likely to have been reported had they occurred in a populated place



Data Source: Boston Consulting Group. (2023). Data Model on Landslides [Data model]. Retrieved from Global Landslide Hazard map – precipitation trigger from the World Bank, NASA Global Landslide Catalogue, NASA Global Susceptibility Map, NOAA CPC Precipitation Data, and WorldPop population databases.



3.3.4 Extreme wind and tropical cyclone

Future global trends

Key takeaways

- Globally, the IPCC in its Special Report on the Ocean and Cryosphere in a Changing Climate report projects an increase in the proportion and peak wind speeds of intense tropical cyclones in future scenarios. The said Special Report also indicates that the proportion of tropical cyclones reaching category 4-5 levels is projected to rise by approximately 1-10% with a 2°C global temperature increase.

Average intensity of Tropical Cyclones (TCs) will increase

Tropical Cyclones (TCs), characterized by their powerful winds and devastating impacts, are among the principal hazards and risks associated with climate change. At the global scale, the IPCC in its Special Report on the Ocean and Cryosphere in a Changing Climate Chapter 6 on Extremes, Abrupt Changes and Managing Risks report indicates high level of confidence among climate scientists regarding the increased proportion and peak wind speeds of intense tropical cyclones in future scenarios. Tropical cyclones are projected to intensify with rising global temperatures, leading to an elevated potential of extreme TCs. According to IPCC, there is medium confidence that the proportion of TCs that reach Category 4–5 levels will increase, that the average intensity of TCs will increase (by roughly 1–10%, assuming a 2°C global temperature rise), and that average TCs precipitation rates (for a given storm) will increase by at least 7% per degree Celsius SST warming, owing to higher atmospheric water vapor content (IPCC, 2019).

Potential Philippines trends

Key takeaways

- While the frequency of TCs within the Philippine Area of Responsibility (PAR) is projected to slightly decrease by up to -11% (~2TCs) in 2030 and up to -13% (~2.5TCs) in 2050 compared to historical (2010-2020) data, the decrease in the number of landfalling TCs is more pronounced, with projections showing a potential decrease of up to -51% to ~52% (~3.5TCs) in 2030 and 2050 (Boston Consulting Group, 2023).
- Despite the decreasing frequency of TCs, the number of typhoons (118-184 km/h) is projected to increase up to 119% (from 3.6 to up to 7.9), or more than double, by 2030 and 2050 compared to historical (2010-2020) data. Additionally, super typhoons (185+ km/h) are projected to slightly increase by around 24% (from 3.3 to up to 4.1) in the 2030 decade and experience a more significant increase of about 76% (from 3.3 to up to 5.8) in the 2050 decade, both compared to historical records (Boston Consulting Group, 2023).
- By 2030 and 2050, tropical cyclones (TCs) are projected to experience significant increases in average maximum peak wind speed, reaching up to a 29% (from 113km/h to up to 146km/h) and 33% (from 113km/h to up to 150km/h) increase, respectively, compared to the historical average from 2010-2020 (Boston Consulting Group, 2023).



As the Philippines is located in a region highly vulnerable to the impacts of TCs, it is crucial to understand the potential trajectory of these TCs for the Philippines. Projections regarding the future behavior of TCs in the Philippine Area of Responsibility (PAR) are derived from an ensemble sophisticated spatial probabilistic model that incorporate statistical correlations between cyclones and various climate drivers⁸³. These models provide valuable insights into the potential changes in TC characteristics, such as intensity and frequency. However, it is important to acknowledge that there are inherent challenges in accurately predicting the behavior and spatial variation of TCs due to their high variability and complex interactions with the climate system. To address these challenges, an ensemble of models is employed, enabling more stable model results for the assessment of future TC behavior.

Decreasing frequency, heightened devastating intensity of TCs

Tropical cyclone (TC) frequency within the Philippine Area of Responsibility (PAR) is projected to slightly decrease in the coming years. Historical data from 2010 to 2020 shows an average of 19.9 TCs annually. By 2030, projections indicate a decline of up to -11%, with 18.2 (SSP2-4.5) or 17.7 (SSP5-8.5) TCs per year (Boston Consulting Group, 2023). This reduction is even more pronounced for landfalling TCs, projected to decrease up to -51% from an average of 7.3 per year between 2010 to 2020 to 4.3 (SSP2-4.5) or 3.6 (SSP5-8.5) by 2030 (see Figure 3.3.4.1) (Boston Consulting Group, 2023).

Looking ahead to 2050, the projected decrease in TC frequency aligns closely with the 2030 figures for both PAR and landfalling TCs (Boston Consulting Group, 2023). The average number of TCs in PAR, previously recorded at 19.9 per year, is projected to decline up to -13% to 18.3 (SSP5-8.5) or 17.3 (SSP2-4.5) annually (Boston Consulting Group, 2023). Similarly, the number of landfalling TCs is projected to decrease up to -52% from 7.3 in 2010 to 2020 to 4.0 (SSP5-8.5) or 3.5 (SSP2-4.5) by 2050 (see Figure 3.3.4.1) (Boston Consulting Group, 2023).

These findings are in line with Climate Model Simulations done by PAGASA and UK Met Office projecting that under the high emission scenario (RCP8.5), three of five model simulations suggest that decrease in TC frequency is significant (DOST-PAGASA, 2018).

The projected decrease in the frequency of tropical cyclones, coupled with an increase in their intensity, can be attributed to a complex interplay of factors driven by climate change. While rising sea surface temperatures provide more energy for storm development and intensification, certain changes in atmospheric circulations within the tropics may act as a counterbalance (Kiest, 2023). The warming of sea surface temperatures is known to fuel storms, making them more powerful. However, the altered atmospheric conditions may create a less favorable environment for the initial

⁸³ Climate drivers including mean sea level pressure, relative humidity (near surface), sea surface temperature, and tropopause temperature



formation of storms (Kiest, 2023). Notably, this intricate relation between several factors underscores the dynamic nature of climate change's impact on TCs and must continue to be closely monitored.

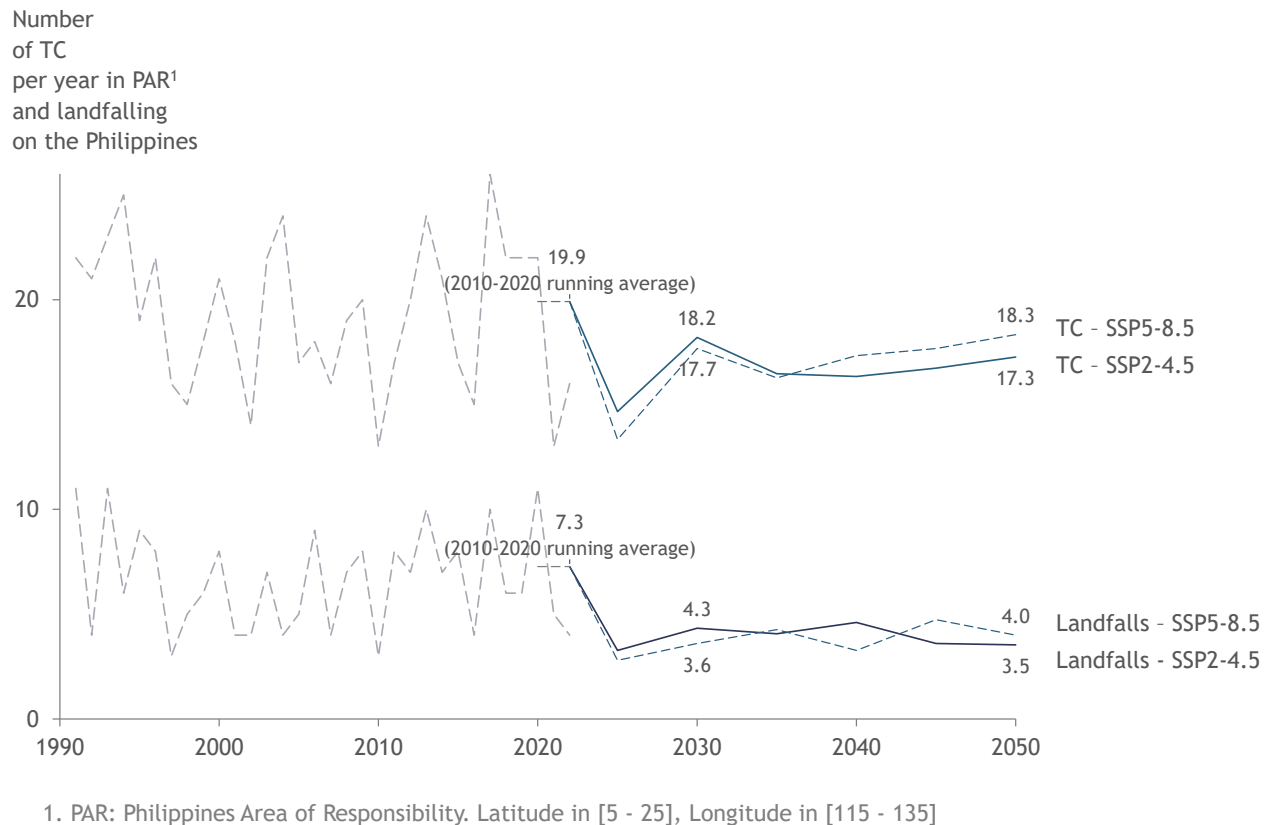


Figure 3.3.4.1: Number of TCs in the Philippine Area of Responsibility and landfalling on the Philippines under SSP2-4.5 and SSP5-8.5 scenarios until period of 2050⁸⁴

Data source: Boston Consulting Group. (2023). Data Model on Tropical Cyclones [Data model]. Retrieved from CMIP6 (Coupled Model Intercomparison Project Phase 6) and International Best Track Archive for Climate Stewardship (IBTrACS) databases.

However, despite the decrease in frequency, there is a noteworthy increase in TC intensity. Projections indicate a twofold increase in the occurrence of typhoons (118-184 km/h) in PAR compared to the previous decade (Boston Consulting Group, 2023). The average of 3.6 typhoons from 2010 to 2020 is projected to increase 119% to reach 7.5 (SSP5-8.5) to 7.9 (SSP2-4.5) per year

⁸⁴ Methodology provided in appendix.



between 2030 and 2040 (Boston Consulting Group, 2023). The number of super typhoons (≥ 185 km/h) is projected to slightly increase 24% from the previous average of 3.3 per year to about 4.0 (SSP5-8.5) to 4.1 (SSP2-4.5) per year (see Figure 3.3.4.2) (Boston Consulting Group, 2023).

By 2050-2060, there is an upward trend in super typhoons in PAR compared to the 2030-2040 projections (Boston Consulting Group, 2023). The range of typhoons per year in 2050 is generally lower than the 2030 figures, ranging from 6.7-7.3 typhoons per year (Boston Consulting Group, 2023). However, the frequency of super typhoons shows a significant increase compared to the 2030 projections (Boston Consulting Group, 2023). Projections anticipate a 76% increase, reaching 5.2 (SSP2-4.5) to 5.8 (SSP5-8.5) super typhoons per year, surpassing the current level of 3.3 per year (see Figure 3.3.4.2) (Boston Consulting Group, 2023). These projections highlight the potential escalation in TC intensity, particularly in the more severe categories, as the years progress.

This substantial increase in the occurrence of stronger cyclones poses significant risks, as they have the potential to unleash stronger associated winds, heavier precipitation, and intensified storm surges, leading to more severe impacts on the affected areas.

Mean annual frequency of cyclones entering PAR¹

Annual # cyclones averaged across 10 years, average max wind speeds in km/h

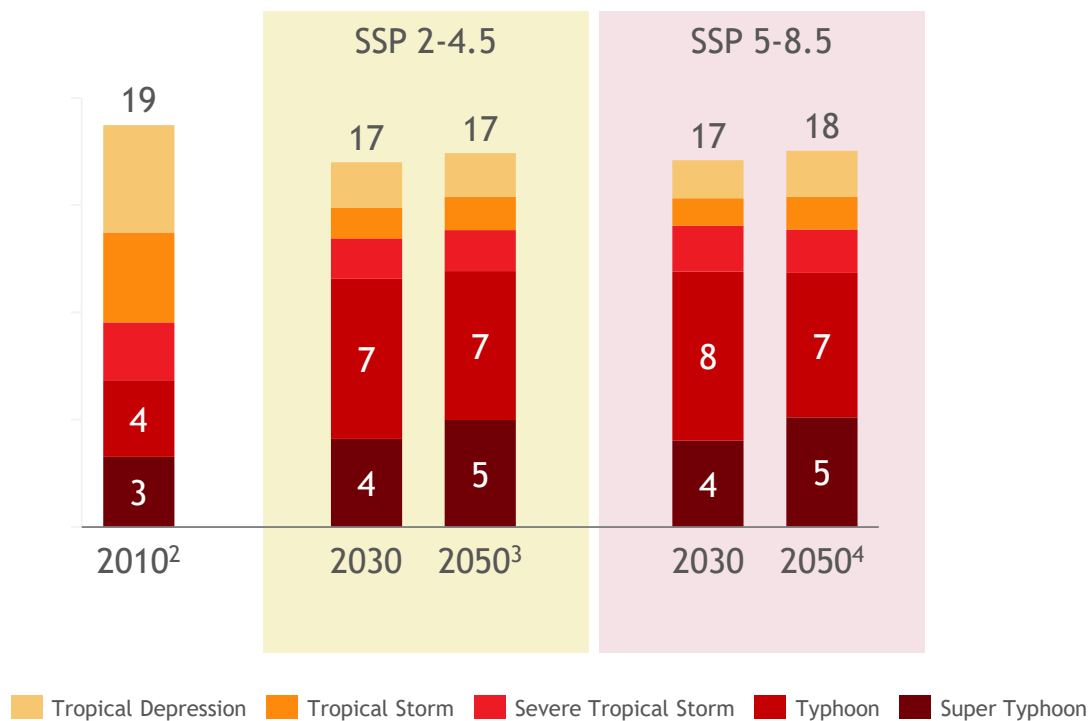




Figure 3.3.4.2: Number of TCs per category in the Philippines under SSP2-4.5 and SSP5-8.5 scenarios in 2030 and 2050 in comparison to 2010-2020 baseline⁸⁵

1. Philippine Area of Responsibility (not landfall)
2. 2010 decade refers to period between 2010-2020
3. 2030 decade refers to period between 2030-2040
4. 2050 decade refers to period between 2050-2060

Note: PAGASA classification used – In terms of maximum sustained winds near the center: Tropical Depression: <62km/h, Tropical storm: >62km/h & < 88km/h, Severe Tropical Storm: >88km/h & < 117 km/h; Typhoon: > 118 km/h & < 184 km/h; Super Typhoons: > 185 km/h

Data source: Boston Consulting Group. (2023). Data Model on Tropical Cyclones [Data model]. Retrieved from CMIP6 (Coupled Model Intercomparison Project Phase 6) and International Best Track Archive for Climate Stewardship (IBTrACS) databases.

TCs projected to surge in peak wind intensity

Projections indicate a notable increase in the average maximum peak wind speed of TCs compared to the 2010 to 2020 average, suggesting potential changes in TC intensity. From 2010-2020, the average maximum wind speed of TCs stood at around 113 km/h per year (Boston Consulting Group, 2023). However, by 2030, projections suggest a potential rise of up to 29%, with average maximum wind speeds reaching 142 km/h (SSP2-4.5) and up to 146 km/h (SSP5-8.5) (Boston Consulting Group, 2023). The strongest TCs in a given year are also projected to see an increase of up to 13%, with average speeds of 225 km/h from 2010-2020 projected to reach 241 km/h (SSP5-8.5) and up to 254 km/h (SSP2-4.5) (see Figure 3.3.4.3) (Boston Consulting Group, 2023).

By 2050, the projected increase in average peak wind speed of TCs is projected to escalate further compared to the 2030 figures. Forecasts estimate an increase of up to 33% compared to the 2010-2020 average of 113 km/h, with average maximum wind speeds ranging from 146 km/h (SSP2-4.5) to 150 km/h (SSP5-8.5) (Boston Consulting Group, 2023). Moreover, the maximum wind speed of the strongest TCs in a given year is projected to rise by 15% by 2050, reaching approximately 258 km/h (SSP2-4.5) to 259 km/h (SSP5-8.5) (Boston Consulting Group, 2023). These figures surpass the 2030 average projections of 241-254 km/h and the previous average of 225 km/h from 2010-2020 (see Figure 3.3.4.3) (Boston Consulting Group, 2023).

⁸⁵ Methodology provided in appendix.

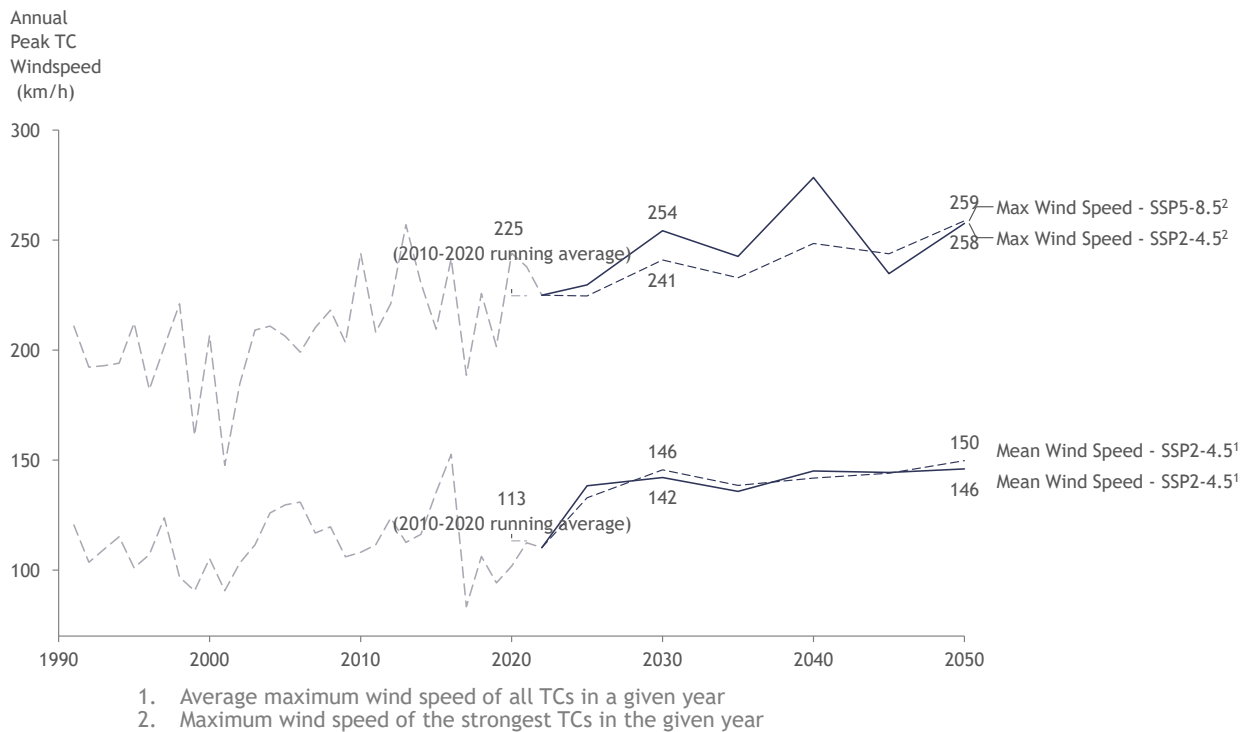


Figure 3.3.4.3: Annual peak TC windspeed (km/h) using cyclone track simulation for Philippine Area of Responsibility across SSP2-4.5 and SSP5-8.5 scenarios until period of 2050⁸⁶

Data source: Boston Consulting Group. (2023). Data Model on Tropical Cyclones [Data model]. Retrieved from CMIP6 (Coupled Model Intercomparison Project Phase 6) and International Best Track Archive for Climate Stewardship (IBTrACS) databases.

These findings align with climate model simulations concerning anticipated shifts in tropical cyclones, as conducted by PAGASA and the UK Met Office. These simulations indicate that among the five models, four concur on an expected increase in tropical cyclone intensity, with two of these projections signifying a noteworthy intensification (DOST-PAGASA, 2018).

Potential socio-economic impact

Key takeaways

- About 6 million Filipinos will face more than one TC occurrence exceeding 118km/h, typhoon and/or super typhoon, translating to PHP 83 billion and PHP 78 billion in the 2030 and 2050 decades (Boston Consulting Group, 2023).

⁸⁶ Methodology provided in appendix.



Socioeconomic Impact: Tropical Cyclones	2030 decade (2030-2040 annualized average)		2050 decade (2050-2060 annualized average)	
	SSP2-4.5	SSP5-8.5	SSP2-4.5	SSP5-8.5
Social impact: Population exposed	1.7 Mn to 5.9 Mn	822 K to 5.3 Mn	1 Mn to 6 Mn	607 K to 6 Mn
Economic Impact: Infrastructure damage (PHP)	56 Bn	83 Bn	73 Bn	78 Bn

Table 3.3.4.1: Social and economic impact of Tropical cyclone occurrence > 118 km/h (Typhoons and/or Super Typhoons)

Note: Figures provided are approximations; Population exposed defined as population located in the track of Typhoons and/or Super Typhoons in a radius of 25-100 square kilometers; Typhoon and Super Typhoon Occurrence: Estimated annual frequency of a Typhoon or Super Typhoon making landfall; 2030 decade: 2030-2040; 2050 decade: 2050-2060; 2010-2020 used as a baseline as data for socio-economic impact is only available from 2010-2020; 1 in 10 year return period

PAGASA classification used – In terms of maximum sustained winds near the center: Tropical Depression: <62km/h, Tropical storm: >62km/h & < 88km/h, Severe Tropical Storm: >88km/h & < 117 km/h; Typhoon: > 118 km/h & < 184 km/h; Super Typhoons: > 185 km/h

Boston Consulting Group. (2023). Data Model on Tropical Cyclones [Data model]. Retrieved from CMIP6 (Coupled Model Intercomparison Project Phase 6) and International Best Track Archive for Climate Stewardship (IBTrACS) databases.

Up to 6 million Filipinos exposed, with economic losses of PHP 83 and 78 billion due to Typhoon and/or Super Typhoon occurrence in 2030 and 2050⁸⁷

Analysis reveals that, within a 25km radius from the center of a Typhoon or Super Typhoon, up to 1.7 million Filipinos (SSP2-4.5) are projected to experience the direct impacts⁸⁸, potentially subjecting these people to displacement due to Typhoon or Super Typhoon destruction (Boston Consulting Group, 2023). Under the broader scenario of a 100km radius from the center of a Typhoon or Super Typhoon, to increase to almost 6 million people impacted (Boston Consulting Group, 2023).

⁸⁷ Methodology provided in appendix.

⁸⁸ Impact defined as areas with greater than 10% Typhoon or Super Typhoon occurrence potential in a 10-year return period, translating to at least one Typhoon or Super Typhoon occurrence in a decade; population impacted defined as population within impacted areas; Typhoon or Super Typhoon Occurrence: Estimated annual frequency of a Typhoon or Super Typhoon making landfall



In both scenarios, around 1 million to 6 million people (SSP2-4.5) potentially encounter least one Typhoon or Super Typhoon during the 2050 decade (Boston Consulting Group, 2023). It is worth mentioning that while the SSP5-8.5 scenario exhibits higher intensity, the overall occurrence of tropical cyclones is not projected to show a significant difference or even decline slightly compared to SSP2-4.5 (Boston Consulting Group, 2023). As a result, there will be a limited change in the number of affected individuals and areas in this regard.

Regarding economic impact, specifically infrastructure damage resulting from the occurrence of typhoons or super typhoons with speeds exceeding 118 km/h, projections indicate potential damages of up to PHP 83 billion by 2030 and PHP 78 billion by 2050 (Boston Consulting Group, 2023).

Most impacted regions

Key takeaways

- Regions in Luzon are projected to be most vulnerable to Typhoon or Super Typhoon occurrence and higher wind intensities compared to other regions (Boston Consulting Group, 2023).
- Top affected regions in terms of Typhoon or Super Typhoon occurrence by the 2030 decade under SSP5-8.5 scenario include regions II (Cagayan Valley), Region IV-B (MIMAROPA), and IV-A (CALABARZON) (Boston Consulting Group, 2023).
- Socioeconomic impact of extreme sea events highest in Luzon regions IV-A, III, and NCR
 - Top regions in terms of population impacted within 100km radius from the center of a typhoon or super typhoon include Luzon regions IV-A (CALABARZON), III (Central Luzon), and NCR, making up 47% (2.5 Mn of 5.3 Mn) of total population impacted within 100km radius from the center of a Typhoon or Super Typhoon and 73% (603k of 822k) of total population impacted within 25km radius from the center of a Typhoon or Super Typhoon by 2030 under SSP5-8.5 scenario (Boston Consulting Group, 2023).
 - These same regions are projected to bear the highest infrastructure damage due to Typhoon and/or Super Typhoon occurrences, accounting for up to PHP 47 billion out of the projected PHP 83 billion (57%) in infrastructure damage by 2030 under SSP5-8.5 (Boston Consulting Group, 2023).

Regions in Luzon projected to be most impacted by Typhoon or Super Typhoon occurrence and increased wind intensity

Regions in Luzon are predicted to be relatively more exposed to Typhoon and/or Super Typhoon occurrence by 2030 and 2050 (see Figure 3.3.4.4). By 2030-2040 decade and under the SSP5-8.5 scenario, regions II: Cagayan Valley, IV-B: MIMAROPA, and IV-A are identified as the most vulnerable regions in terms of the overall occurrence of TC occurrence >118km/h, or Typhoons and/or Super Typhoons (Boston Consulting Group, 2023).



In this scenario, region II faces a potential of 89% for the occurrence of Typhoon or Super Typhoons in a year, which translates to an average of one Typhoon or Super Typhoon every 1.1 years. Region IV-B exhibits potential of 58% for the occurrence of Typhoon or Super Typhoons in a year, with an average frequency of one Typhoon or Super Typhoon every 1.7 years. Region IV-A faces a high potential of TC occurrence of 47%, translating to one Typhoon or Super Typhoon every 2.1 years (Boston Consulting Group, 2023).

Albeit similar frequency levels compared to the 2020 country profile, it must be recognized that the intensity of these cyclones is projected to escalate over time. By 2030 and 2050, TCs are projected to intensify across the nation, with a more pronounced impact in the Luzon regions (see Figure 3.3.4.5). These regions require special attention and preparedness measures to mitigate the impacts of these potentially devastating weather events.

Regions IV-A (Calabarzon), III (Central Luzon), and NCR (National Capital Region) in Luzon will have the largest absolute socioeconomic impact

Furthermore, in terms of the absolute number of the population impacted, with population impacted defined as the population within a 25km to 100km radius of the center of the cyclone, the data shows that Regions IV-A (Calabarzon), III (Central Luzon), and NCR (National Capital Region) make up 47% (2.5 Mn of 5.3 Mn) of the total population impacted within a 100km radius from the center of a Typhoon or Super Typhoon and 73% (603k of 822k) of the total population impacted within a 25km radius from the center of a Typhoon or Super Typhoon by 2030 under SSP5-8.5 scenario (see Table 3.3.4.2) (Boston Consulting Group, 2023).

These same regions are projected to bear the highest infrastructure damage due to Typhoon and/or Super Typhoon occurrences, accounting for up to PHP 47 billion out of the projected PHP 83 billion (57%) in infrastructure damage by 2030 under SSP5-8.5 (Boston Consulting Group, 2023).

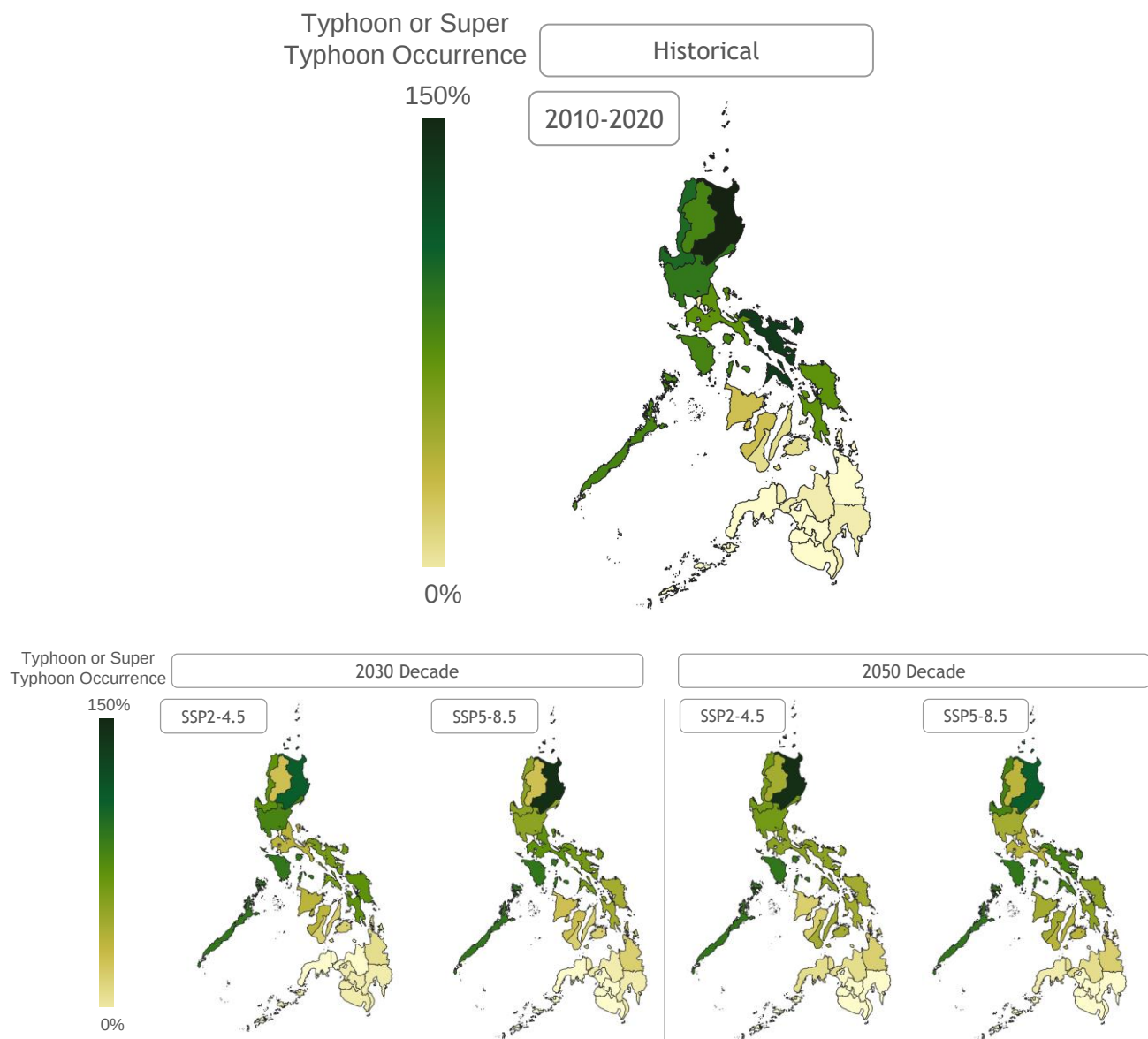
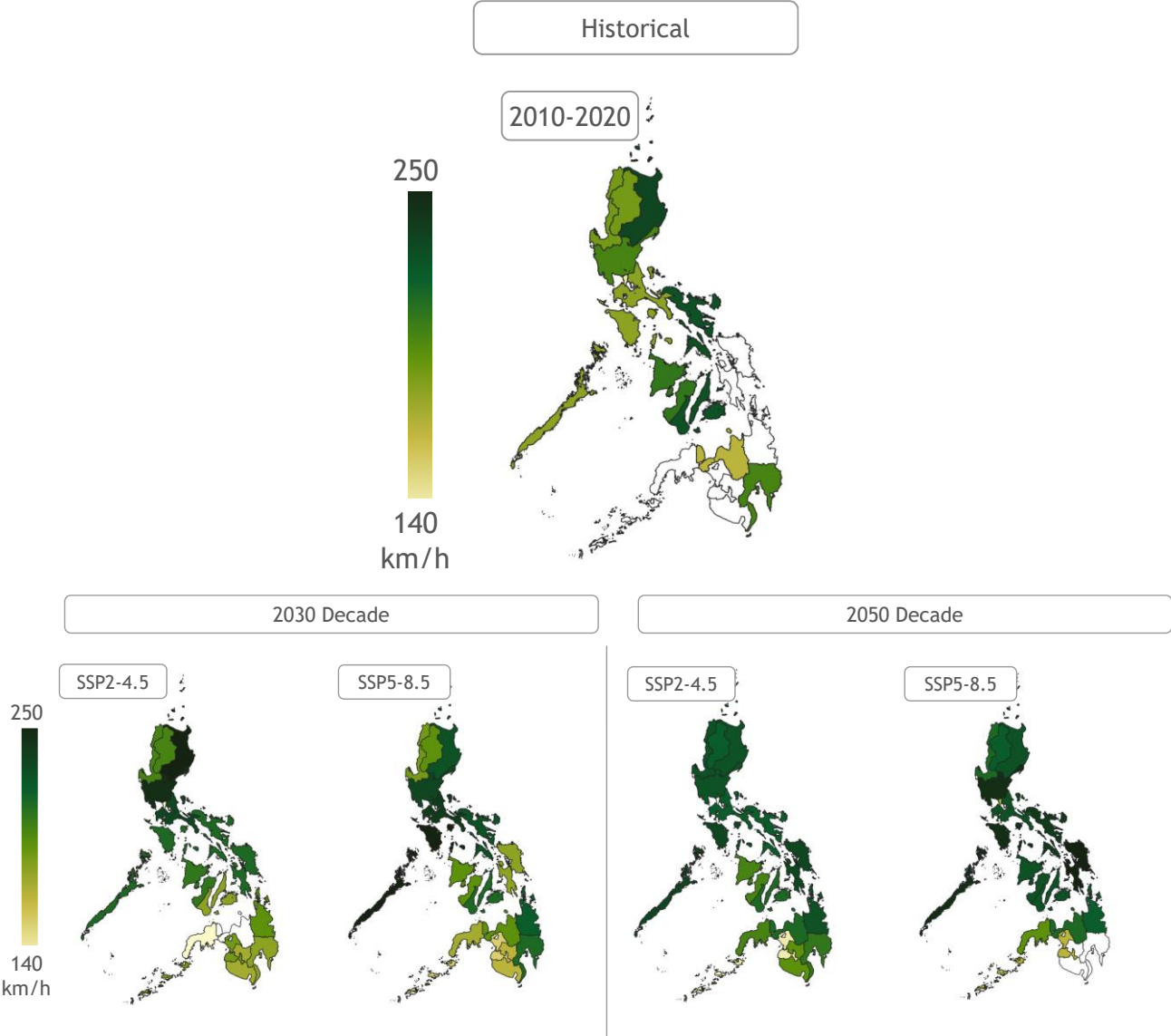


Figure 3.3.4.4: Typhoon and Super Typhoon occurrence potential by 2030 and 2050 decade

Note: Typhoon and Super Typhoon Occurrence: Estimated annual frequency of a Typhoon or Super Typhoon making landfall; 2030 decade: 2030-2040; 2050 decade: 2050-2060; 2010-2020 used as a baseline as data for socio-economic impact is only available from 2010-2020

PAGASA classification used – In terms of maximum sustained winds near the center: Tropical Depression: <62km/h, Tropical storm: >62km/h & < 88km/h, Severe Tropical Storm: >88km/h & < 117 km/h; Typhoon: > 118 km/h & < 184 km/h; Super Typhoons: > 185 km/h

Data source: Boston Consulting Group. (2023). Data Model on Tropical Cyclones [Data model]. Retrieved from CMIP6 (Coupled Model Intercomparison Project Phase 6) and International Best Track Archive for Climate Stewardship (IBTrACS) databases.



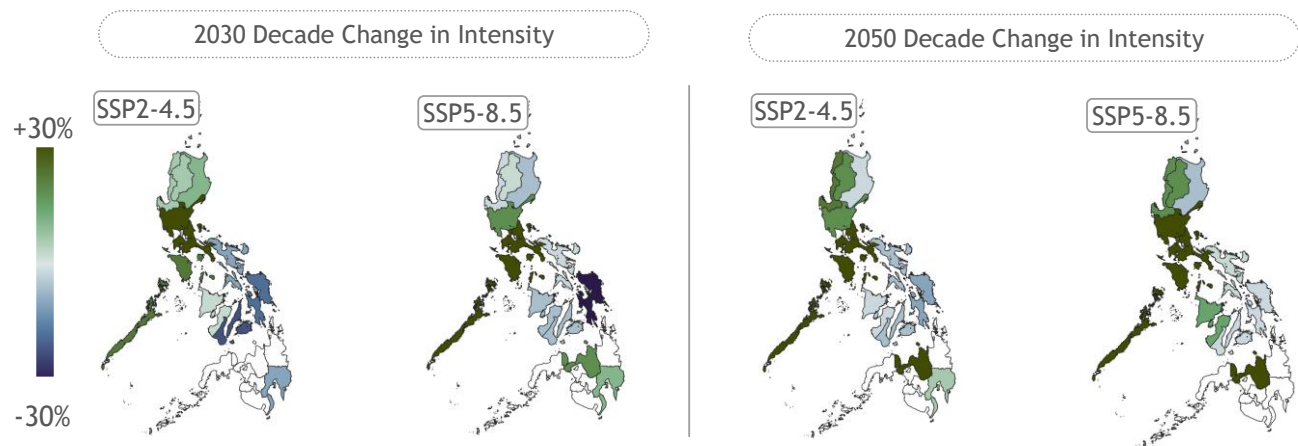


Figure 3.3.4.5: Upper panel – Maximum wind intensity of Typhoons and Super Typhoons; Lower panel – change in maximum wind intensity of Typhoon or Super Typhoons versus 2010-2020 baseline

Note: 2030 decade: 2030-2040; 2050 decade: 2050-2060; 2010-2020 used as a baseline as data for socio-economic impact is only available from 2010-2020

PAGASA classification used – In terms of maximum sustained winds near the center: Tropical Depression: <62km/h, Tropical storm: >62km/h & < 88km/h, Severe Tropical Storm: >88km/h & < 117 km/h; Typhoon: > 118 km/h & < 184 km/h; Super Typhoons: > 185 km/h

Data source: Boston Consulting Group. (2023). Data Model on Tropical Cyclones [Data model]. Retrieved from CMIP6 (Coupled Model Intercomparison Project Phase 6) and International Best Track Archive for Climate Stewardship (IBTrACS) databases.



Region	Typhon and/or Super Typhoon Occurrence	Max wind speed (km/h)	Pop. impacted (k people) within 100km radius	% of total pop. (2020 figures)	Pop. impacted (k people) within 25km radius	% of total pop. (2020 figures)	Area impacted ('000 sq km) 25km to 100km range	% of total area impacted	Economic impact (PHP Bn)
Region II	89%	220	241	7%	20	1%	1-22	4% - 77%	2
Region IV-B	58%	248	166	5%	26	1%	2 -15	6% - 55%	3
Region IV-A	47%	232	1,048	7%	411	3%	3 -14	17% - 85%	27
Region V	44%	218	410	7%	29	0%	1 -13	5% - 75%	6
Region I	40%	180	341	7%	60	1%	1 -10	8%- 76%	5
Region III	36%	224	772	6%	58	0%	3 -17	16% - 78%	11
Region VIII	31%	172	282	6%	11	0%	1 -15	3% - 71%	2
Region VI	24%	184	503	6%	-	0%	0-12	0% - 59%	8
CAR	22%	183	110	6%	52	3%	-	-	2
Region XIII	18%	214	156	6%	15	1%	0-9	1% - 46%	2
Region VII	16%	204	493	6%	3	0%	1 -5	7% - 33%	4
Region XI	7%	205	-	0%	-	0%	0-7	1% - 38%	0



Region X	7%	182	106	2%	4	0%	0-4	0% - 22%	1
Region XII	4%	154	-	0%	-	0%	0-1	0% - 4%	0
Region IX	4%	161	-	0%	-	0%	-	-	0
National Capital Region	4%	220	714	6%	135	1%	0-1	4% - 86%	9
Bangsamoro Autonomous Region in Muslim Mindanao	2%	139	-	0%	-	0%	0-1	0% - 7%	1

 Top metrics under each category

Table 3.3.4.2: Typhoon and/or Super Typhoon occurrence in a 10-year return period, maximum wind speed, population impacted by Typhoon or Super Typhoon occurrence in a 100km and 25km radius from the center of the cyclone, area impacted, and percent of total area impacted by Typhoon or Super Typhoon occurrence in a 100km and 25km radius from the center of the cyclone, and economic impact (PHP) under SSP5-8.5 scenario by 2030-2040 decade

Note: Table sorted based on Typhoon or Super Typhoon occurrence column; Figures highlighted indicate top figures under respective metrics

Typhoon or Super Typhoon Occurrence: Estimated annual frequency of a Typhoon or Super Typhoon making landfall; 2030 decade: 2030-2040; 2050 decade: 2050-2060

2010-2020 used as a baseline as data for socio-economic impact is only available from 2010-2020

Population and area impacted defined as population and area located in the track of Typhoons and Super Typhoons' in a radius of 25 to 100km from the center of the cyclone



PAGASA classification used – In terms of maximum sustained winds near the center: Tropical Depression: <62km/h, Tropical storm: >62km/h & < 88km/h, Severe Tropical Storm: >88km/h & < 117 km/h; Typhoon: > 118 km/h & < 184 km/h; Super Typhoons: > 185 km/h

Data source: Boston Consulting Group. (2023). Data Model on Tropical Cyclones [Data model]. Retrieved from CMIP6 (Coupled Model Intercomparison Project Phase 6) and International Best Track Archive for Climate Stewardship (IBTrACS) databases.



3.3.5 Provincial categorization based on climate exposure

The previous sections in this subchapter delved into each CID and the social, economic, and physical impacts they may bring to the Philippines. **In this section of the National Adaptation Plan (NAP), the information from previous subsections is used to categorize provinces based on the exposure they are projected to face in the coming decades.** The considered dimensions span across the physical, social, and economic domains, and are analyzed both for individual CIDs as well as at an overall, multi-CID level.

As a nation with finite resources and exceedingly diverse levels of vulnerability across different provinces, this categorization helps support optimized decision making and distribution of resources, concentrating support where it is most urgently needed. While analyses in previous sections were done at a regional level, categorizations were further distilled into provinces given the presence of governing bodies at the provincial level – mapping of provinces to their respective regions can be seen in Appendix 1. **As a nation with finite resources and exceedingly diverse levels of vulnerability across different provinces, this categorization helps support optimized decision making and distribution of resources, concentrating support where it is most urgently needed.** While analyses in previous sections were done at a regional level, categorizations were further distilled into provinces given the presence of governing bodies at the provincial level – mapping of provinces to their respective regions can be seen in Appendix 1.

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Provinces are split into 5 distinct categories, depending on percentile value of their exposure compared across other Philippine provinces, defined in Figure 3.3.5.1. Figure 3.3.5.2 showcases a risk categorization splitting provinces into quintiles⁸⁹ based on exposure arising from climate-driven social, economic, and physical impacts across all CIDs⁹⁰ in the decade of 2030, SSP5-8.5. CID-specific categorizations and detailed information on methodology can be found in Appendix 1.

⁸⁹ Provinces within each quintile are listed in alphabetical order.

⁹⁰ Dimensions were weighted to ensure equal significance of physical, social, and economic impacts.

Sea level rise, Extreme Sea Levels, pluvial and fluvial flooding: Social - absolute population exposed and % of provincial population exposed, absolute and % of provincial impoverished population exposed; Economic - Damage cost as an absolute number and as a % of regional GDP; Physical: Absolute area exposed and % of total provincial area exposed.

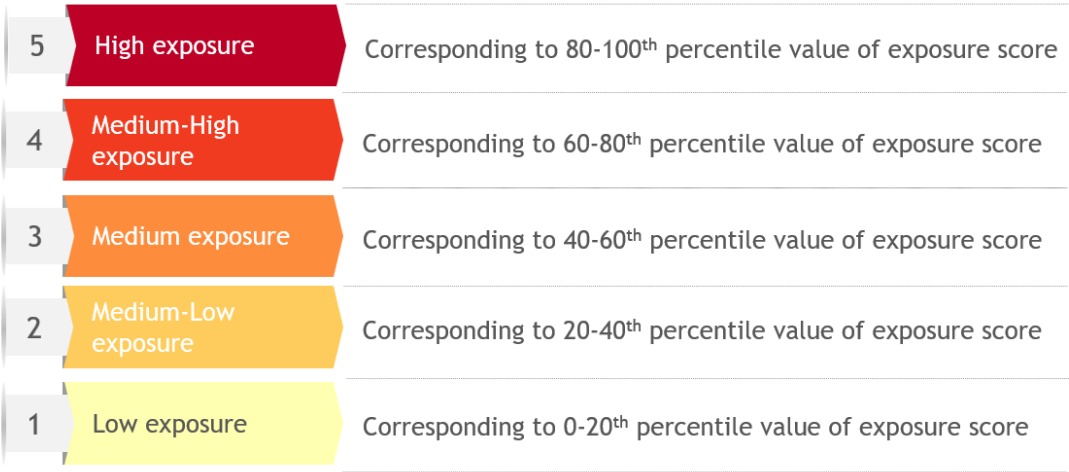
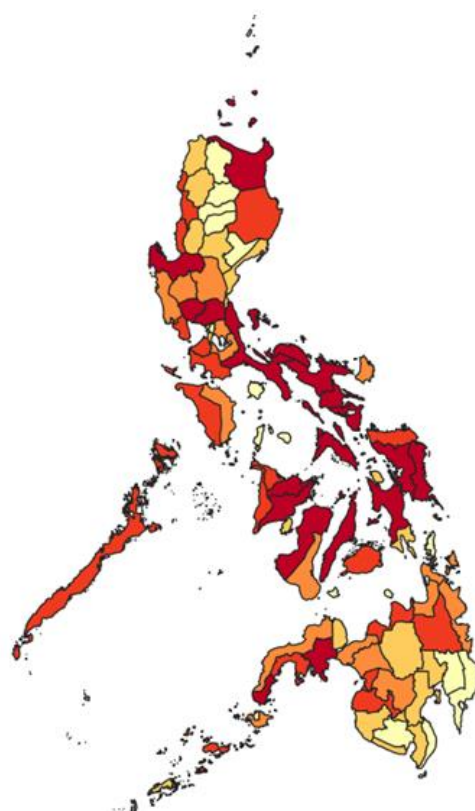


Figure 3.3.5.1 Definition of each risk category

Extreme Heat: Social - absolute # agricultural & construction workers in region and as % of total region workforce.

Extreme Wind: Social - absolute population exposed and % of provincial population exposed, absolute and % of provincial impoverished population exposed; Economic - Damage cost as an absolute number and as a % of regional GDP.



High Exposure	Medium-High Exposure	Medium Exposure	Medium-Low Exposure	Low Exposure
Province	Province	Province	Province	Province
Albay	Agusan del Sur	Agusan del Norte	Abra	Apayao
Bulacan	Aklan	Basilan	Aurora	Batanes
Cagayan	Antique	Catanduanes	Benguet	Camiguin
Camarines Norte	Bataan	Cotabato	Biliran	City of Isabela
Camarines Sur	Batangas	Cotabato City	Bukidnon	Davao de Oro
Capiz	Bohol	Laguna	Davao del Norte	Davao Occidental
Cebu	Cavite	Lanao del Norte	Davao del Sur	Davao Oriental
Eastern Samar	Ilocos Sur	Lanao del Sur	Guimaras	Dinagat Islands
Iloilo	Isabela	Negros Oriental	Ilocos Norte	Ifugao
Leyte	La Union	Nueva Ecija	Misamis Occidental	Kalinga
Masbate	Maguindanao	Oriental Mindoro	NCR, City of Manila, First District	Marinduque
Negros Occidental	Misamis Oriental	Rizal	NCR, Fourth District	Mountain Province
Pampanga	Northern Samar	Surigao del Norte	NCR, Third District	NCR, Second District
Pangasinan	Occidental Mindoro	Surigao del Sur	Nueva Vizcaya	Quirino
Quezon	Palawan	Tarlac	Sarangani	Romblon
Samar	Sulu	Zambales	Southern Leyte	Siquijor
Sorsogon	Zamboanga Sibugay	Zamboanga del Norte	Sultan Kudarat	South Cotabato
Zamboanga del Sur			Tawi-Tawi	

Figure 3.3.5.2 Projected provincial risk categorization between 2030-40, SSP5-8.5

Note: Provinces arranged alphabetically within each category



The provincial categorization highlighted above, when combined with factors such as vulnerability and adaptive capacity serves as an insightful reference point to support decision-making on adaptation action at a localised level. It is important to note that many of the components that make up this categorization will need to be downscaled at a more granular level in the future. Moving forward, downscaled, localized studies within high-risk localities must be performed to supplement this analysis. Combined, these studies can then enable well-informed selection of adaptation strategies, which can be chosen from the portfolios identified in the following chapter on Adaptation Priorities.



3.4 Social vulnerability and underlying impact-drivers

The concept of vulnerability encompasses a broad spectrum of interpretations within existing literature. While commonly viewed as a precondition, some scholars interpret it as an outcome. Vulnerability encompasses three distinct aspects: it indicates a result rather than a cause; it signifies an unfavorable outcome; and it operates as a comparative term, distinguishing among socio-economic groups or regions rather than serving as an absolute gauge of deprivation (Downing, 1991). The Intergovernmental Panel on Climate Change (IPCC) provides a definition rooted in exposure, susceptibility, and adaptive capacity: "*Vulnerability delineates the degree to which a system is prone to, or unable to effectively manage, detrimental impacts stemming from climate change, encompassing variations in climate patterns and extremes. This factor hinges not solely on a system's sensitivity but also on its capacity to adapt.*" (IPCC, 2007).

In its Synthesis Report of the 6th Assessment Cycle, the IPCC further stated:

Approximately 3.3 to 3.6 billion people live in contexts that are highly vulnerable to climate change. Human and ecosystem vulnerability are interdependent. Regions and people with considerable development constraints have high vulnerability to climatic hazards. Increasing weather and climate extreme events have exposed millions of people to acute food insecurity and reduced water security, with the largest adverse impacts observed in many locations and/or communities in Africa, Asia, Central and South America, LDCs, Small Islands and the Arctic, and globally for Indigenous Peoples, small-scale food producers and low-income households. Between 2010 and 2020, human mortality from floods, droughts and storms was 15 times higher in highly vulnerable regions, compared to regions with very low vulnerability.⁹¹

In the context of comprehensive climate risk assessment, vulnerability includes environmental, physical, technical, social, cultural, economic, institutional, and policy-related factors that contribute to susceptibility and/or lack of capacity to prepare, prevent, cope, or adapt.⁹² The study "Approaches to the Vulnerability to Climate Change"⁹³ posited that vulnerability to climate change encompasses changes in individual and collective vulnerability over time associated with the changing incidence of extreme events. Policies relevant to the reduction of social vulnerability to climate variability also support the capacity of vulnerable groups to maintain resources and to invest in maintaining these resources in the long run. Building social capital and trust networks, especially with state institutions, becomes essential due to extreme events and disasters.[1]

⁹¹ A.2.2, https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_SPM.pdf

⁹² UNDRR (2022) "Technical Guidance on Comprehensive Risk Assessment and Planning in the Context of Climate Change", United Nations Office for Disaster Risk Reduction

⁹³ Adger, W. Neil. Center for Social and Economic Research on the Global Environment, University of East Anglia and University College London. 1995//ISSN 0967-8875.



The components of social vulnerability vary, underlining the multidimensionality and heterogeneity of social vulnerability across different geographies, levels of governance, and local contexts.[2] The factors that characterize vulnerability include socio-economic status (e.g., income, political power, and prestige), gender, race and ethnicity, age, rural/urban location, residential property, renters, family structure, education, social dependence, and special needs populations, among others.[3] In Metro Manila, low-income households in informal settlements do not have adequate access to potable water, electricity, health services, and sewage and sanitation facilities suffer significant impacts from tropical cyclones, floods, and tidal/storm surges.[4] In remote coastal communities, factors that influence social vulnerability include are household size, members with disability, and travel time to town center.[5]

Mortality rates from tropical cyclones are influenced more by population exposure and socio-economic conditions rather than the hazard itself.[6] In the Super Typhoon Haiyan-affected areas in Leyte, exposure to flood and storm surge, vulnerability of livelihoods, low level of information and awareness, and lack of disaster preparedness contributed to social vulnerability.[7] Communities living in areas prone to tropical cyclones and floods are found to be highly vulnerable to chronic poverty, showing a positive correlation between poverty and the frequency of tropical cyclones or disasters.[8]

Through social vulnerability analysis, the relationships between climate impacts, adaptation strategies, and socio-economic impacts can be defined, qualified, and quantified. This analysis is undertaken at macro, meso, and micro levels looking into the vertical and horizontal linkages and interactions of social variables.[9] Through a composite social vulnerability index in the Philippines, for example, a trend of decreasing social vulnerability from south to north is observed within the municipalities of the southern and western coastal regions of MIMAROPA, Zamboanga Peninsula, BARMM and SOCCSKSARGEN exhibiting the highest levels of social vulnerability.[10, 11] The structure of social vulnerability among urban populations is found to be evolving, and becoming complex involving multiple stakeholders based on social vulnerability analyses conducted in Metro Manila, Iloilo City, and Naga City. [12]

The data modeling exercises in the above sub-chapters feature four (4) Climactic Impact Drivers (CID)— (1) increased temperature and drought, (2) extreme precipitation, (3) sea level rise and extreme sea levels, and (4) extreme winds and tropical cyclones—which were prioritized to understand the impacts of climate change in the Philippines and upon which adaptation options were derived across the targeted sector outcomes. This process reflects the value of more granular information and datasets as a means to highlight the aspect of social protection among the purposes of the NAP.

Each CID was analyzed in terms of its impacts, taking into account that projections indicate hazards to significantly intensify for the country under 2030 (short-term) and 2050 (long-term) horizons, and under the Shared Socioeconomic Pathway (SSP) 2-4.5 and SSP5-8.5 scenarios.

To illustrate the regard for the social dimension of the NAP, the data analytics highlight the following:



- a. Incorporation of estimates of economic impacts by the CIDs; and
- b. Computation of ranking of regions based on CID vulnerability.

The social indicators are then applied to ensure that the solutions are inclusive and appropriate as they aim to increase adaptive capacity, and at the same time, to leverage investment opportunities.

The application of Cost-Benefit Analysis, Social Accounting Matrix, and the use of scorecards is necessary to capture local (in terms of location) and social (in terms of human and community dimensions) vulnerability and are conducted to support targeted and deliberate determination of solutions based on scientific assessments of gaps and needs for adaptation and sustainable development.

The various interventions advanced by the UNDRR in its “**disaster risk reduction tools and methods for climate change adaptation**”⁹⁴ support an effective framework for consolidating knowledge and experiences on disaster management and climate action to build adaptive capacity by communities. Seven (7) approaches, applicable to particular regions, cover the following areas of intervention:

- a. Political commitment and institutional aspects
- b. Risk identification and early warning
- c. Knowledge management and education
- d. Risk management applications
- e. Preparedness and response

The foregoing methodological approaches are considered to be helpful in ushering in a future-thinking approach to managing climate risks, and, ultimately, establish a cohesive, convergent, and results-oriented adaptation planning and implementation. This is consistent with the National Climate Risk Management Framework (NCRMF), which upholds an anticipatory, probabilistic, and holistic risk assessment, planning, and management approach in support of sustainable development.

⁹⁴ <https://www.undrr.org/publication/disaster-risk-reduction-tools-and-methods-climate-change-adaptation>



Adaptation Priorities

Chapter

04



4. Adaptation Priorities

4.1 Introduction to Priority Sectors for Adaptation and Resilience

This chapter of the NAP outlines the adaptation priorities for eight sectors that underpin the Philippines' economic and social development as determined by the logical framework outlined in Chapter 1. As underscored in the previous chapters, the frequency and intensity of multiple climatic-impact drivers, the significant uncertainties of future risks due to climate change, and various challenges in implementing adaptation solutions all call for a systematic approach to defining and prioritizing strategies to increase resiliency.

To effectively (i) build resilience to minimize climate-related loss and damage and (ii) increase adaptive capacity towards the transformation of resilient and sustainable socioeconomic development, eight key sectors have been selected as the focal points for adaptation actions. These sectors have been determined as key pillars for societal well-being and stability, as well as pillars for economic resilience. These sectors include **Agriculture and Fisheries and Food Security, Water Resources, Health, Ecosystems and Biodiversity, Culture Heritage, Population Displacement and Migration, Land Use and Human Settlements, Livelihoods and Industries, and Energy, Transport and Communications.**

The table below provides an overview of the importance of the sector and the sectors' need for adaptation and resilience considering impacts of climate change:

Sector	Importance of sector and the need for adaptation & resilience ⁹⁵
Agriculture and Fisheries and Food Security	The production of crops, livestock, aquaculture, and fishery systems in the Philippines is critical to food security as 75% of food consumed in the country is produced locally. In addition, one out of ten households in the Philippines continue to be food insecure. Additionally, agriculture is a significant sector for the economy as it contributes 9% to GDP. The sector constitutes a quarter of the nation's workforce, with 30% of this segment living in poverty, leading to their heightened vulnerability against climate change.
Water Resources	Water resources are essential for human survival as well as economic activity, such as agricultural irrigation, fishery production, hydropower generation, and industrial production.

⁹⁵ Sources for key statistics and information per sector can be found in the respective sectoral sub-chapters in Chapter 4.2



	A rapidly growing population without appropriate planning and investment into water systems has led to national water stress levels twice of the global average – 12.4 million (12%) Filipinos lack basic access to drinking water (2015), while 26 million Filipinos do not have access to basic sanitation. This situation may be further exacerbated by the impacts of climate change, leading to cascading impacts to other sectors such as health, where contaminated water sources are a major source of waterborne diseases in the Philippines.
Health	More than 110 million Filipinos rely on the healthcare system to effectively anticipate, respond, and recover from climate-related disasters and climate-induced diseases. Climate change drivers have been seen to increase the incidence of vector-borne diseases like dengue and malaria. With only 56% of public health facilities sufficiently stocked with selected essential medicines and less than 25% of cities and municipalities having health worker density above recommended levels, the sector has limited capacity to respond effectively to sudden and increased healthcare demands, disproportionately impacting low-income populations who cannot afford private healthcare.
Ecosystems and Biodiversity	The Philippines's ecosystem makes it one of the 18 mega-biodiverse countries in the world, while also providing livelihood and value across key industries locally such as aquaculture, agriculture, fisheries, and tourism, and protecting surrounding communities from climate hazards. In particular, the Philippines's coral reefs (~70k PHP/ha annually), forests (~200k PHP/ha annually), and mangroves (~200k PHP/ha annually) have been estimated to generate billions of Philippine pesos in ecosystem services annually. These ecosystems have been heavily exploited over the past decade due to both manmade developments and climatic-impact drivers, putting both the ecosystems and the communities who depend on them for livelihood and protection at risk.
Cultural Heritage, Population Displacement and Migration	Extreme climate event and risks will continue to affect migration patterns in the country: more than 15 million Filipinos were estimated to be displaced by 245 climate disaster events from 2020 to 2022.



	Especially vulnerable to displacement and migration caused by sudden-onset climate events (e.g., typhoons, etc.) and slow onset climate risks (e.g., rising sea levels, etc.) are 14-17 million indigenous people (IP) that inhabit the Philippines, belonging to 110 different ethnolinguistic groups, with 73% of all IPs belonging to 40% poorest of the population.
Land Use and Human Settlements	With 60% of Philippine cities located along the coast, the country's coastal areas and low-lying regions are especially susceptible to climate hazards, where an estimated 5.4 million Filipinos live. Rapid urbanization has led to unplanned land use and increasing informal settlements in hazard-prone areas; an estimated 2.45 million impoverished Filipinos live in informal settlements, who have limited ability and resources to withstand and recover from climate disasters.
Livelihoods and Industries	Resilience in key industries in the Philippines must be built to protect the country's economic and social stability amidst increasing climate hazards and risks, especially since industries and their energy supplies are also major contributors to greenhouse gas emissions. Key industries that contribute heavily to the Philippines' GDP must be protected, particularly the Manufacturing (17.2%), Tourism (6.2%), and Professional Services (6.1%)⁹⁶, thus, safeguarding the livelihood of over 12 million Filipinos who rely on these industries.
Energy, Transport and Communications	Infrastructure such as energy, transport, and communications make up critical systems that empower and interconnect industries, businesses, and households, facilitating economic activities and growth while providing communities with access to essential services. Rapid economic and population growth combined with poorly implemented programs have led to overloaded infrastructure systems resulting in the Philippines having 1/3 the average kWh per capita, as well as having among the highest people-to-telecom-tower ratio at over 6000. The infrastructure systems are also among the most vulnerable to climate change, putting the

⁹⁶ Agriculture is also a key contributor to Philippines' GDP (9%); adaptation priorities for this sector is captured under "Agriculture and Fisheries and Food Security"



	various communities and organizations that depend on these services at risk. Future climate change may also change the demand required for these infrastructure services and it is critical to balance adaptation efforts with mitigation efforts given that current energy and transport systems are major emitters of greenhouse gases.

While adaptation priorities in this NAP are outlined per sector, the NAP also recognizes the inextricable links between various sectors and emphasizes the need for an integrated approach to climate adaptation. The diagram below presents a non-exhaustive illustration of select interlinkages across various sectors.

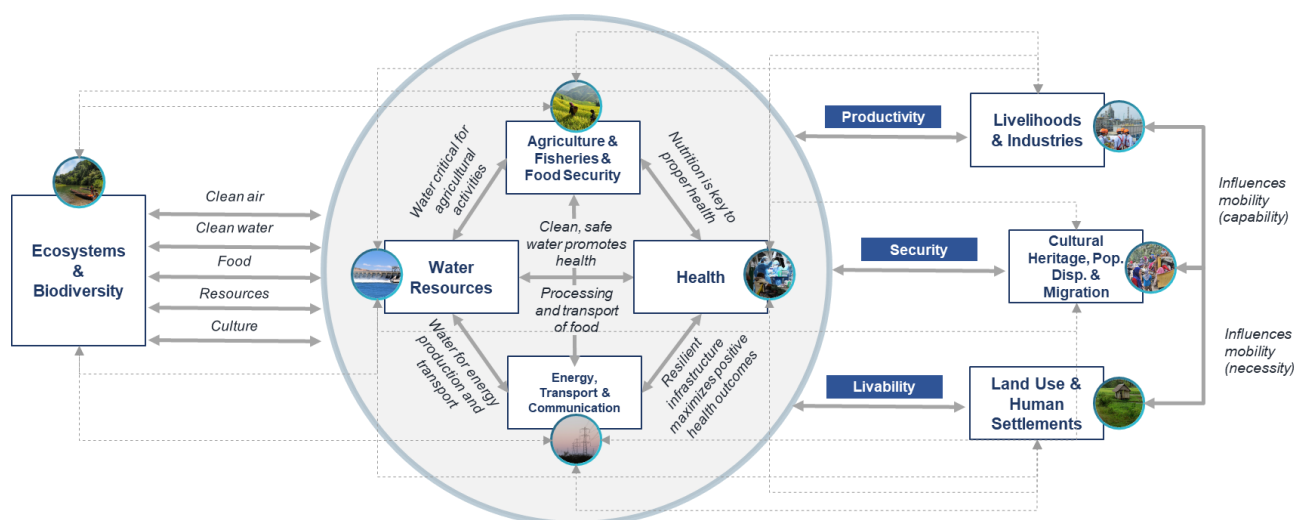


Figure 4.1.1. Sample illustration on select interdependencies across key sectors

Ecosystems and biodiversity serve as the life support system, providing a range of services that directly and indirectly support human well-being and survival. These services are inexplicitly tied to clean air and water, food production, climate regulation, and cultural and recreational values. Recognizing the critical importance of ecosystems is paramount, as their resilience directly impacts the longevity of access to basic needs. Protecting and restoring these ecosystems not only safeguards biodiversity but also enhances resilience to climate impacts, ensuring the sustainability of essential services for all Filipinos.

Essential human needs across sectors are deeply intertwined, forming a complex web of dependencies. Disruptions in any of these areas can trigger cascading impacts on other pivotal domains. For instance, a severe drought affecting water resources can have devastating consequences on agriculture and fisheries and food security, as well as on energy and health outcomes due to water scarcity and increased temperatures. Disruptions in energy, transport and communications can disrupt access to health infrastructure through flooded roads, or interrupt health services due to power outages. The same can be said about impacts on agriculture and food security: disruptions in critical infrastructure can impact food processing and transport.



Strengthening resilience in these 'essential' domains not only benefits each sector individually but also cascades to strengthen security for Cultural Heritage, Population Displacement and Migration, sustain productivity in Livelihoods and Industries, and ensure livability in Land Use and Human Settlements. A more resilient agricultural sector, for example, can enhance food security, reducing the need for population displacement and migration due to resource scarcity. Similarly, investments in sustainable land use and human settlements can mitigate the impacts of extreme weather events and support communities' adaptability. The NAP emphasizes the value of these interconnected benefits, promoting a synergistic approach that maximizes the co-benefits across sectors to build a more resilient and adaptive Philippines.

Beyond sectors above, other factors may also influence the effectiveness of the Philippines' climate response. For example, the nexus between population dynamics and the adaptive capacity of communities is a critical consideration when implementing the Philippine NAP. A growing population can either amplify vulnerabilities or contribute to resilience, depending on the availability of resources, infrastructure, and socio-economic conditions. Rapid population growth can strain limited resources and infrastructure, making it challenging for communities to effectively adapt to climate impacts. On the other hand, a stable and well-managed population can enhance a community's adaptive capabilities, enabling strong ability to absorb shocks and recover from climate-related events.

In summary, disruptions in any one sector or factor can create a vicious cycle of vulnerability and exacerbate the challenges of climate change. Protecting and enhancing ecosystems, understanding the interdependencies among essential human needs, and strengthening resilience across sectors are all central tenets of the plan. Thus, the NAP recognizes the necessity of integrated, cross-sectoral approaches to address these interdependencies and promote holistic resilience.

4.1.1 Sectoral Categorization Based on Climate Risks

A broad estimation of the impacts across the climatic-impact drivers to each sector was conducted. In line with the methodology for high-level socioeconomic model, the projected cost of inaction quantifies costs associated to infrastructure damage, productivity loss, and relocation of populations in relation to each sector. Recognizing these aspects holds significant implications for determining the optimal timing and approach that the Philippines should adopt in addressing adaptation measures for each of these sectors.

Economic implications of inaction in the face of climate change impacts are unambiguous. The cost of inaction in the 2030 decade is estimated to be PHP 645 billion/ per year across these eight sectors⁹⁷. Failing to proactively address the challenges posed by climate change places not only the well-being of Filipinos at risk but also poses a substantial economic burden for the nation.

Four of the eight sectors, including Land Use and Human Settlements, Energy, Transport and Communications, Livelihood and Industries, and Agriculture and Fisheries, have economic costs of inaction sizeable enough to spur action. For these sectors, the case for taking adaptive measures is clear: there is a compelling need to accelerate efforts to mitigate the cost of inaction. Doing so is

⁹⁷ Estimated through climate analytics models using scenario SSP 5-8.5 across 5 climatic impact-drivers and attributed to selected sectors; overall economic cost of inaction including impacts beyond eight sectors are outlined in Chapter 3; detailed methodology for the climate analytics model found on Appendix 2



crucial to ensuring the continuous functioning of critical infrastructure, protecting communities, and sustaining livelihoods in the face of an increasingly unpredictable climate.

However, it is equally crucial to consider other indirect, social costs of inaction, such as health impacts, loss of ecosystem services, conflict and security risks and psychological and social stress. While these costs are not comprehensively quantified within socioeconomic models, a comprehensive assessment might reveal that these indirect consequences can be equally, if not more, detrimental to the Philippines.

Sectors such as Water Resources, Cultural Heritage, Population Displacement and Migration, Ecosystems and Biodiversity and Food Security are sectors that provide for essential human needs. Social costs attributed to systemic impacts in case disruptions happen in these sectors can vary widely. For these sectors, the approach to adaptation action may differ: there is a need for next-level impact assessments to trace pathways by which initial climate change impacts can trigger secondary and tertiary consequences.

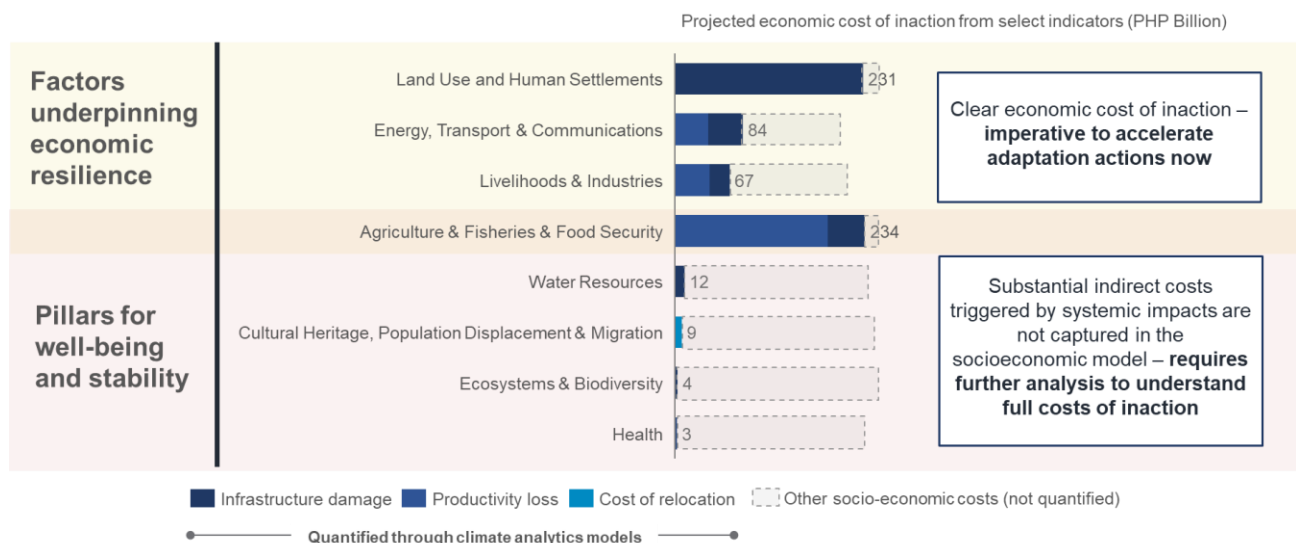


Figure 4.1.2. Implications of adaptation and resilience actions based on projected socio-economic cost of inaction across sectors

4.1.2 Qualitative Assessment of Existing Strategies

A review of existing mechanisms, including replicable or scalable case studies, can concretely model the way for cost-effective and transformative adaptation solutions that are founded on the best available science and recognize the value of traditional knowledge and tested practices on the ground.

One way to grasp a rather broad context of adaptation action is through an assessment of the first iteration of the **NCCAP Monitoring and Evaluation Report for the period 2011-2016**⁹⁸. The development pathways under each thematic priority in the NCCAP (i.e., food security, water sufficiency, ecosystems and environmental stability, human security, climate-smart industries and

⁹⁸ Climate Change Commission. (2019). Executive Brief: The Philippine National Climate Change Action Plan, Monitoring and Evaluation Report 2011-2016. Manila, Philippines.



services, sustainable energy, and knowledge and capacity development) were evaluated on the following parameters:

1. Target intermediate outcome
2. Context
3. Supporting policies
4. Funding
5. Involved agencies
6. Key projects and flagship actions
7. Relevant studies considered
8. Key findings on accomplishments and gaps (based on policy context for climate change mainstreaming; institutional cooperation for adaptation, mitigation, and disaster risk reduction; progress on adaptation; relevant targeting of adaptation options, and prioritization on adaptation public financing)

The NCCAP M&E 2011-2016 provides valuable points to adopt certain paradigm shifts in terms of the context and methodological considerations of adaptation actions, which are explored to be incorporated in this NAP. This includes the following:

- a. Science serves as the basis for framing long-term adaptation planning, utilizing modeled scenarios based on proper baselines and specific time horizons.
- b. Funding mobilization should consider inputs from private sector stakeholders and should capture innovative approaches to climate finance while leveraging public sector investment. This should consider the People's Survival Fund, other climate and disaster funding mechanisms, and development assistance facilities for holistic governance of climate adaptation measures. The practice of Climate Change Expenditure Tagging (CCET) across a significant number of national government agencies and in some local government units, which provides further analysis on the correlation of agency budgets with projected risks in programs and activities.
- c. Co-benefits should be an integral component of the assessment, as adaptation is the anchor strategy of the Philippines under the National Framework Strategy on Climate Change, and that mitigation, while functioning as "adaptation," should concretely provide pathways for emissions reduction and avoidance.
- d. The delivery of the means of implementation under the Paris Agreement should be tracked and evaluated, and should be aligned with the needs-based, evidence-supported adaptation priorities.
- e. A reliable data tracking system on the physical, financial, and social impact progress of climate action should be established. A general inventory of policy levers and global opportunities for scaling up climate action should be conducted to optimize the emerging space for innovation and transformation. Given these insights, a reconfigured M&E structure and process could be formulated to align with the core dimensions and considerations of the NAP, as a reenergized platform to pursue climate change adaptation over the long term, consistent with the best available science, including local and indigenous knowledge, and best available technologies.

The updated **Philippine Development Plan 2022-2028** provides a dedicated chapter on climate change, under Chapter 15: Accelerate Climate Action and Strengthen Disaster Resilience.



Chapter 15 focuses on the challenges faced in climate action and disaster risk reduction and outlines the outcomes to be pursued to address these challenges during the period, namely: (a) climate and disaster risk resilience of communities and institutions increased, (b) ecosystem resilience enhanced, (c) low carbon economy transition enabled, and (d) governance and intersectionality of climate change and natural hazard resilience improved.

As part of the assessment and challenges, the chapter recognizes that numerous policies have been adopted to ramp up climate action and strengthen disaster resilience. Apart from citing critical adaptation roadmaps on water security, natural capital accounting, flood risk master plans, green financing and bonds, and early warning systems, it reiterated the importance of mainstreaming climate action at the local and community level.

This imperative underscores the importance of local-specific climate adaptation solutions based on unique CIDs. Investments, therefore, need to be attuned to infrastructure support, social protection, and financing strategies to implement fit-for-purpose solutions that address social vulnerability of communities.

Inadequate government budget allocation provides impetus to rethink climate financing regimes to catalyze public and private support for climate action. This includes grants, subsidies, and incentives for particular investment areas seen to enhance the capacity of human resources and unlock the potential for innovation.

Analyzing the strategies in harmony with the other critical roadmaps of government such as the Risk Resiliency Program, Public Investment Program 2023-2028, updated National Security Policy 2023-2028, Resilient and Green Human Settlements Framework, National Innovation Agenda and Strategy Document 2023-2032, and National Research and Development Agenda 2022-2028, promotes a transdisciplinary approach towards inclusive, socially informed, and science-based climate actions and decisions over the long term.

4.1.3 Approach to Determining Adaptation Priorities

Sector-specific adaptation themes are crafted for each sector, underpinned by a set of priority adaptation outcomes, a consequent set of adaptation strategies and a high-level determination of key implementation levers. These strategies are anchored on an understanding of the sector's progress and challenges in the Philippines, as well as an overview of the qualitative and quantitative climate change impacts on the sector based on current and future projected climate risks.

Taking into consideration an understanding of the past, present and future of these sectors, priority outcomes are determined to serve as the guiding objectives to ensure sectors are resilient to climate change.

Quantitative indicators to measure success tied to these outcomes per sector will be determined as part of the implementation process. As indicators are determined, it will be critical to get the concurrence of implementing agencies in alignment with their own plans and strategies.

Adaptation strategies for each of these priority outcomes were then determined and prioritized with sectoral experts and various stakeholders to shape a full view of the Philippines' adaptation priorities. Prioritization criteria was used to determine priority sectoral strategies including alignment with existing mandates, breadth of coverage across hazards and/or outcomes, scalability, track record and maturity, and urgency. These key strategies outlined in the NAP are by no means an exhaustive list



of strategies for the sector. Further downscaling and contextualization may reveal additional strategies that further support identified priority outcomes. Lastly, to ensure that the Philippines can turn theory in action, the NAP outlines high-level actors and implementation timelines for each strategy.

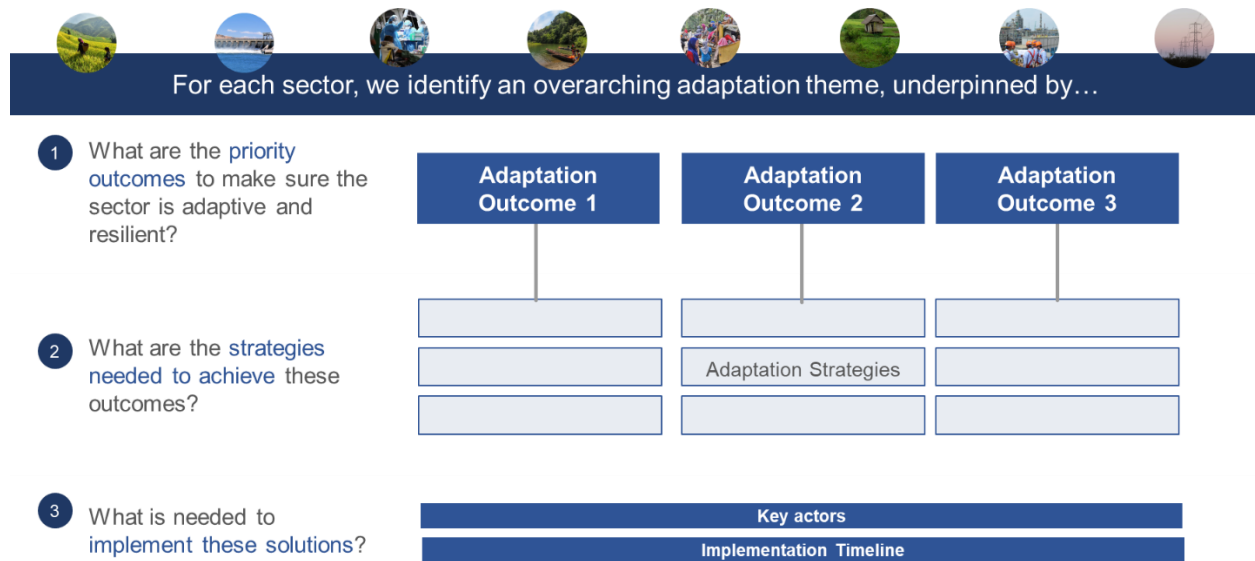


Figure 4.1.3. Approach to determining adaptation priorities across sectors

The determination of adaptation outcomes and strategies for the Philippines rests on two fundamental approaches.

First, the approach **emphasizes the vital role of representative voices within each sector, with intent to uncover insights from those who possess an intimate understanding of the prevailing gaps and challenges in building climate resilience.** The NAP development undertook an inclusive, multi-stakeholder approach to ensure voices are presented onto priority adaptation outcomes and consequent strategies. This included dedicated sector-focused ideation sessions, workshops, and expert consultations with in-country sectoral experts to validate key gaps and critical strategies required to accelerate adaptation efforts in each sector. Members of national government, local government, civil society representatives, academe, private sector, and development partners were provided various avenues to engage on these priorities.

Second, the approach **commits to building on the foundations and progress established by various stakeholders, both governmental and non-governmental, in relation to climate resilience.** The NAP aims to complement ongoing initiatives, mechanisms, programs, and policies, with the ultimate intent of driving towards a more robust and collective endeavor. While the NAP outlines strategies to amplify ongoing initiatives, an evaluation of these initiatives, mechanisms, programs, and policies must be made in parallel, in consideration of its contributions to transformative adaptation.

Moving forward, a few key considerations must be integrated as the NAP is downscaled and implemented.

One, adaptation outcomes and strategies provide guidance on the shared goals of the Philippines in relation to climate adaptation and resilience. However, adaptation strategies are



crafted at a national level and are intended to be tailored to the specific contexts of regions and localities, aligning with localized projected climate impacts. The intent is for regional and local stakeholders to view adaptation strategies in this document as guidance for contextualization. They are empowered to choose and customize actions that align with the unique circumstances and climate conditions of their respective localities, provided a standardized criteria on where customization decisions can be made.

Two, the NAP recognizes the critical importance of integrating sectoral adaptation strategies as a cornerstone of effective climate resilience planning. Climate change impacts are multifaceted and often cut across various sectors such as agriculture, water resources, infrastructure, and health. The country now needs a holistic, systems-thinking lens that recognizes the complex interplay of climate impacts, socioeconomic factors, health systems, and environmental systems, integrating an approach that harmonizes policies and interventions that address these systems collectively.

Isolated sectoral approaches may lead to unintended consequences and potential maladaptation, where efforts in one sector inadvertently undermine progress in another. Therefore, the NAP emphasizes the need to downscale adaptation planning to more localized levels, ensuring that communities and regions are equipped to address the specific challenges they face.

To address the risk of maladaptation, a crucial step in this downscaling process involves bringing together sector-specific adaptation strategies into a comprehensive systems model. This systems approach enables an understanding of how various adaptation measures interact with one another. By mapping out these interactions, local authorities can identify potential feedback loops that can either amplify or mitigate the effects of climate change. For example, strategies aimed at enhancing agricultural resilience might have ripple effects on water resources, ecosystem health, and food security. Understanding these connections allows for more informed decision-making and the optimization of adaptation efforts.

Lastly, beyond considerations of maladaptation, localized adaptation implementation also needs to consider adaptation limits. In certain cases, challenges to implementation are "soft" in nature, meaning that effective adaptation measures do exist. Implementation of these measures is hindered by economic, political, and social barriers, such as a lack of technical support or insufficient funding. However, implementors also need to be critical of instances where climate impacts are already so severe that no existing adaptation strategies can completely prevent further loss and damage. Efforts to introduce adaptation strategies may continue to lead to loss and damage as opposed to increased resilience.

Emphasizing the recognition of the spectrum between soft and hard limits to adaptation is not only essential for enhancing the nation's resilience to climate change but also for harnessing co-benefits with climate mitigation efforts.



4.2 Sectoral Priority Outcomes and Adaptation Solutions

This sub-chapter outlines the envisioned adaptation theme, outcomes and strategies tailored to each sector. These adaptation strategies were determined based on a comprehensive understanding of each sector, encompassing current progress and prevailing challenges in building resilience, and equipped with a deep understanding of the projected climate risks attributed to the sector. The following diagram highlights the adaptation themes and common strategies across sectors.



Figure 4.2.1. Sector-specific adaptation themes and common adaptation strategies

Five common strategies are observed across the sectors:

1. Strengthen infrastructure resilience. There is a need to reinforce the resilience of critical infrastructure in various sectors to withstand adverse impacts and disruptions caused by climate



change. From water infrastructure to production facilities to power plants to roads and seaports, resiliency against climate hazards must be built to minimize disruptions of services.

2. Safeguard livelihoods with social protection and regulations. With the unpredictability and magnitude of projected climate events, livelihoods, especially those of vulnerable populations, may be put at risk. This key strategy focuses on actions and mechanisms that safeguard the livelihoods of populations from the impacts of climate change through social safety nets and climate-responsive regulations.

3. Empower local governments and communities to take adaptation action. Policy frameworks provide the ambition, vision, and direction that the Philippines can work towards as one, but action and implementation for adaptation & resilience must happen at local and community levels. This key strategy articulates the importance of enabling local governments and communities to implement adaptation solutions by mainstreaming understanding of adaptation and resilience through access to climate data and tools and increasing capacity to act.

4. Mainstream integrated adaptation governance. Enacting adaptation solutions will require a multi-stakeholder and multi-disciplinary approach. It will require facilitating common discussions among experts from multiple sectors and groups with various agendas. This strategy articulates the importance of fostering a coordinated collaboration among stakeholders, policymakers, and institutions across horizontal and vertical chains of command.

5. Scale nature-based solutions. Given the richness of natural assets in the Philippines, this strategy articulates the importance of prioritizing the usage of nature-based solutions where possible, to drive climate resilience and protect vulnerable populations. Today, the mainstream solution to build adaptation and resilience is to invest in grey infrastructure such as sea walls that often have detrimental offsets to populations in the area (i.e., maladaptation). This is especially important given the co-benefits with climate mitigation.

The detailed climate impacts and adaptation strategies for each sector can be found in the following sub-sections in this chapter including:

- Overview of the sector
- Climate change impacts to the sector
- Priority adaptation outcomes for the sector
- Priority adaptation strategies for the sector



4.2.1 Agriculture and Fisheries and Food security

Overview of Agriculture and Fisheries and Food Security in the Philippines

Crops, livestock, fish farms and fisheries in the Philippines play a pivotal role in the Philippines, serving as a cornerstone of the country's economy and ensuring food security for the population. Economically, the sector contributes to 8.9% of the nation's GDP in 2022. While the Philippines is involved in a wide array of agricultural practices, its production is predominantly focused on the cultivation of crops (57.8%), rearing of livestock (14.4%), poultry (15.1%), and fishery-related activities (12.7%) as of the first quarter of 2023. Agricultural land also makes up more than 40% of the nation's land area, underscoring the significance of this sector.

From a social perspective, this sector serves as a critical source for Filipinos' food supply and livelihood. The four biggest contributors to the average Filipino's diet were cereals (40.2%), vegetables (15.5%), fish (11.2%), and meat (10.8%)⁹⁹ – of this, 75% of food consumed was produced domestically in 2021¹⁰⁰, with all the local produce of certain key crops, such as rice, being consumed within the country. Agriculture also serves as the source of income for a substantial portion of the population, with almost a quarter of Filipinos being employed in the agricultural sector.

The agriculture and fisheries and food security sector as a whole faces key challenges across resource bases, labor, capital, productivity, and policy among other factors that has led to its relatively slow growth compared to other major economic sectors in the Philippines, as well as prevailing food insecurity across the nation. The average Philippine farm was just 1.29 hectares in 2012¹⁰¹, severely limiting productivity gains from economies of scale. This was partly driven by the growing rural Filipino demographic, but also policies such as the Comprehensive Agrarian Reform Program, which broke up larger farmlands, reducing the average farm size by a third¹⁰², in turn decreasing national agricultural productivity by 17%. Resource bases have also been poorly managed, with farmers facing issues accessing enough water, while 70% of Philippine grounds are overfished impacting fisherfolks' productivity. This decrease in agricultural productivity, among other contributing factors, have led to moderate to severe food insecurity observed across 3 out of every 10 Filipino households¹⁰³.

⁹⁹ Department of Science and Technology - Food and Nutrition Research Institute (DOST-FNRI). 2022. Philippine Nutrition Facts and Figures: 2018-2019 Expanded National Nutrition Survey (ENNS): Food Consumption Survey. FNRI Bldg., DOST Compound, Gen. Santos Avenue, Bicutan, Taguig City, Metro Manila, Philippines.

¹⁰⁰ Philippine Statistics Authority. (2022). Food Balance Sheets of the Philippines, 2019-2021.

¹⁰¹ Briones, R.M., (2021). Philippine agriculture: Current state, challenges, and ways forward. Philippine Institute for Development Studies

¹⁰² Adamopoulos, T. and D. Restuccia. 2020. Land reform and productivity: A quantitative analysis with micro data. American Economic Journal: Macroeconomics 2020 12(3):1–39.

¹⁰³ Department of Science and Technology - Food and Nutrition Research Institute (DOST-FNRI). 2022. Philippine Nutrition Facts and Figures: 2018-2019 Expanded National Nutrition Survey (ENNS): Food Consumption Survey. FNRI Bldg., DOST Compound, Gen. Santos Avenue, Bicutan, Taguig City, Metro Manila, Philippines.



Adding to the issues, both farmers and fisherfolk face challenges in accessing the market. This is seen physically, with the need for more storage facilities and transportation infrastructure to facilitate the delivery of goods to consumers, but also manifests itself in other ways – most farmers and fisherfolk are smallholders, and cascading of best practices, reasonable prices, and other aspects of selling their goods must be strengthened, to minimize their market cost and raise their income. These issues have led to farmers and fisherfolk having the highest poverty incidence rates in the Philippines, at 30% and 30.6% respectively as of 2021, according to the Philippine Statistics Authority¹⁰⁴.

Climate Change Impacts on Agriculture and Fisheries and Food Security

Agriculture and Fisheries and Food Security are historically one of the most vulnerable sectors to climate change. Despite technological advancements in recent decades, productivity of farms and fisheries is still heavily dependent on weather and climate. The projected increases in temperatures, changes in rainfall patterns, increases in severity and frequency of extreme weather and climate events and their associated impacts on water availability, and pest and disease outbreaks will substantially affect the agricultural production. This has been observed globally, with climate change causing 280 billion USD (4%) in losses of crop and livestock production across the world from 2008-2018¹⁰⁵. These impacts are exacerbated in the Philippines, which experiences one of the highest disaster risk levels in the world. For example, over 7.4 million hectares of Philippine agricultural area were affected by typhoons, floods, and droughts from 2000-2010, leading to over 100 billion PHP in damages¹⁰⁶.

On fisheries, the study performed by Barboza, Camaso, Macusi, and Macusi¹⁰⁷ found that 94% of a sample of Filipino fisherfolk within the Davao Gulf had experienced decreases in their catch, a phenomenon observed to be driven by climate change. Additionally, global models project a decline of 9%-24% in potential marine fisheries across the Philippines by 2050. Exacerbating these issues is the high poverty incidence rate and the proximity to the coastline in the case of fisherfolk, compounding the vulnerabilities faced by the Filipinos who depend on agriculture, aquaculture, and fisheries as their source of livelihood – poor access to resources amongst impoverished communities have been shown to lead to conflicts within and across communities, with incidences of looting, ransacking, and bloodshed having been recorded in the past¹⁰⁸.

¹⁰⁴ Philippine Statistics Authority. (2021). 2021 Full Year Official Poverty Statistics Among The Basic Sector in the Philippines

¹⁰⁵ FAO (2021), The Impact of Disasters and Crises on Agriculture and Food Security 2021, FAO, Rome, <http://www.fao.org/3/cb3673en/cb3673en.pdf>.

¹⁰⁶ Briones, R.M., Israel, D.C. (2012). Impacts of Natural Disasters on Agriculture, Food Security, and Natural Resources and Environment in the Philippines. PIDS Discussion Paper Series

¹⁰⁷ Macusi ED, Camaso KL, Barboza A and Macusi ES (2021) Perceived Vulnerability and Climate Change Impacts on Small-Scale Fisheries in Davao Gulf, Philippines. *Front. Mar. Sci.* 8:597385. doi: 10.3389/fmars.2021.597385

¹⁰⁸ Montaña, T. & Gonzales, A. (2018). Human Insecurity and Conflict: Effect of Coastal Communities' Vulnerability to Climate Change. *International Journal of Environmental Science and Development*. 9. 187-191. 10.18178/ijesd.2018.9.7.1098.



Worsening climate trends will severely impact the agriculture and fisheries and food security sector if no action is taken. For example, typhoons with higher peak wind speeds will damage farmland and fishery infrastructure, while degrading produce. Increasing temperatures are also expected to lead to reduced crop yield, degraded livestock health, and decreasing potential fishery catch. The table below highlights negatives of other climatic impact-drivers on this sector.

Table 4.2.1.1. Impacts of climate hazards on Agriculture and Fisheries and Food Security

Climatic impact-driver	Impacts to Agriculture and Fisheries and Food Security sector
Increased temperature and drought	Heat stress across crops, livestock, and fish Increased temperature reduces yield of rice and other crops, driven by heat stress, shortened growing periods, and other factors. Livestock also experience heat stress, degrading health and productivity. Farmed fish, fisheries, and seaweed yield are projected to decrease, with longer fish culture period and increased fish mortality contributing to this. Increased incidence pests and diseases Increased temperature has been observed to bring about increased incidence of pests and diseases. Water stress across crops and livestock Drought leads to water stress across both crops and livestock potentially leading to reduced yield, productivity, and quality. Droughts have also led to farmers not planting, leading to disrupted cropping schedules. Soil degradation Lack of soil moisture leads to reduced nutrient content, hindering nutrient absorption and thus reducing crop yield and health. Decreased productivity amongst farmers & fisherfolk Increased temperature may lead to heat-related illnesses, reduced productivity, and mental health impacts for farmers & fisherfolk. Reduced fish supply Rising sea water temperature can lead to coral bleaching. This translates to reduced catches of reef fishes which can have an impact on fish supply and associated economic activities.
Sea level rise and extreme sea levels	Salinity intrusion of farmland Sea level rise may lead to salinity intrusion into farmland and fishponds, and substantial shortages of water for irrigation in countries with extensive



	coastline and river deltas. As an archipelago with similar geographical features, the Philippines is at risk of finding itself in a similar situation. Inundated farmland Rising sea levels also threaten to inundate farmland, leading to loss of crop productivity and livelihoods of farmers impacted. Storm surges damaging fishing infrastructure Storm surges may cause damage across fishing infrastructure situated along the coast, such as piers, docks, boats, and equipment. Reduced fish supply Rising sea levels may lead to loss of mangroves, reducing spawning and nursery grounds for many fishes, which can have an impact on fish supply and associated economic activities.
Extreme precipitation	Flood damaging soil, crop, and fish health Extreme precipitation leads to floods which have a myriad of impacts on agriculture. Topsoil can be eroded reducing soil fertility and thus crop yields, and crops can be physically impacted leading to dislodging, bruising, etc. Post-harvest inability to dry wet crops leads to post-harvest losses. This causes increases in cost of farming, which may lead to forest degradation as compensation for reduced productivity of existing farmland. In aquaculture, flooding damages infrastructure, and may lead to income loss from escaped stocks or the invasion of unwanted species in aquaculture farms. Prolonged rainfall also leads to hypoxia (depletion of dissolved oxygen) resulting to fish kills. Waterlogging Excessive rainfall causes waterlogging, causing poor aeration and hindered nutrient absorption. Prolonged moisture may also lead to diseases and fungal infections impacting crop yield. Waterlogging in surrounding forest ecosystems may also lead to habitat degradation causing the spread of pest and vectors of diseases.
Wind patterns and tropical cyclones	Crop, Land, and infrastructure damage Wind patterns and tropical cyclones risk uprooting and destroying crops, hence reducing yield. Additionally, infrastructure such as roads and storage facilities can be damaged, impacting the agricultural supply chain and in effect the Philippines's food security. Soil erosion of farmland



	Wind patterns and tropical cyclones lead to soil erosion, removing essential nutrients and fertilizer for crop growth and health - this leads to reduced crop yields and harvests. Reduced fishing days Cyclones prevent fishers from going out to sea to fish resulting to lessened productive days and decreased income, further increasing their vulnerability.

Amidst the various climatic impact-drivers, **pluvial flooding and extreme sea levels are expected to impact farms and fishponds the most, respectively¹⁰⁹**. Across the decade of 2030-2040, 7.5% of agricultural land is projected to be exposed to pluvial floods – this exposure will be particularly significant in regions II, IV-A, V, VI, and VIII, where over a third of the exposed farmland will be located.

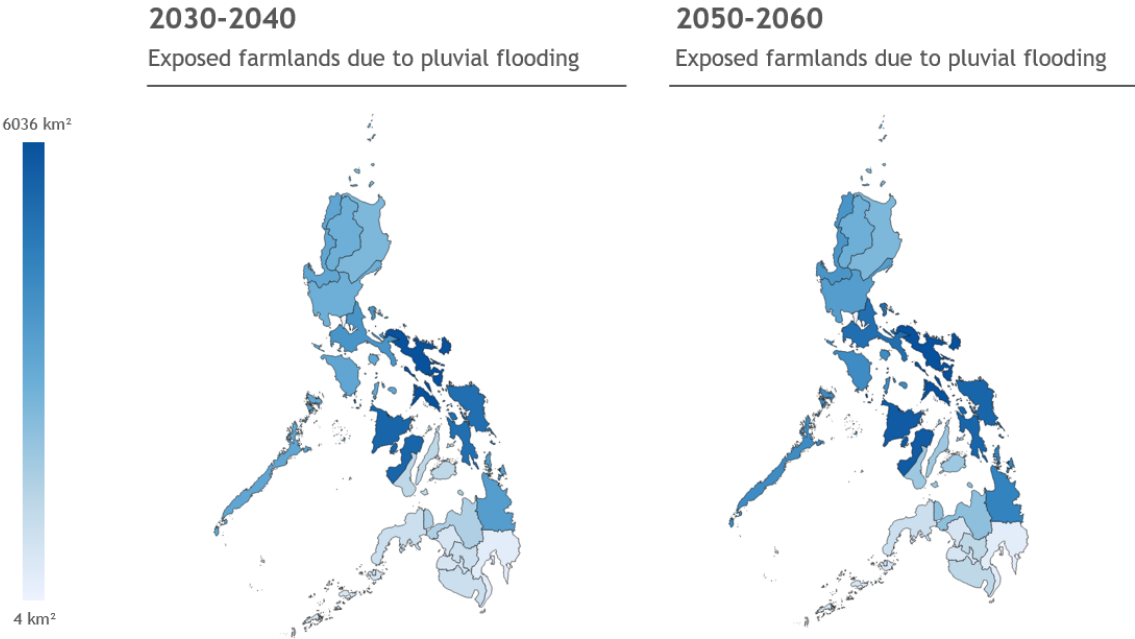


Figure 4.2.1.1 Exposed farmland due to pluvial flooding from 2030-40, 2050-60, SSP5-8.5

Due to their proximity to the coast, fishponds are projected to face the highest exposure to extreme sea levels – between 2030-2040, 15% of fishponds are expected to be exposed to extreme sea levels, with 80% of the exposure occurring within Regions I, III, and IV-A, V, and VI.

¹⁰⁹ Quantitative climate impacts outlined in this chapter are projected based on climate models developed as part of the National Adaptation Plan process. Detailed methodology for climate models per sector can be viewed on Appendix 3 – Agriculture and Fisheries and Food Security

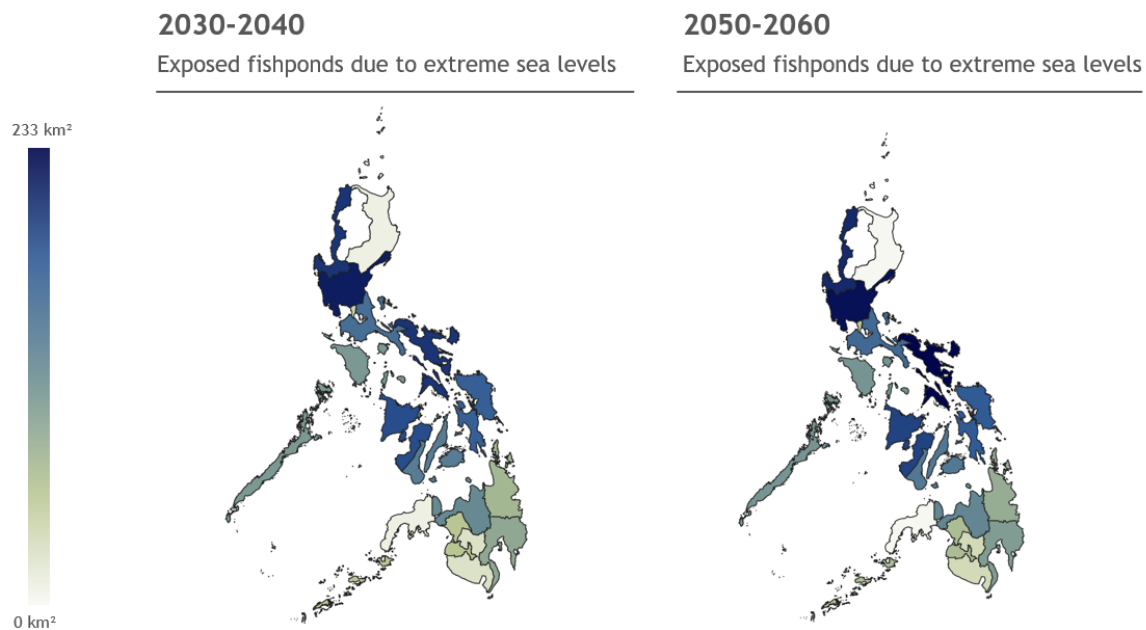


Figure 4.2.1.2 Exposed fishponds due to extreme sea levels from 2030-40, 2050-60, SSP 5-8.5

Furthermore, when considering rice and corn yields, two crucial crops for both production and consumption in the Philippines, there is a projected decline in yield of 6% for rice and 19% for corn by 2030. Provinces with the largest decrease in rice production are Camarines Sur, Nueva Ecija, and Masbate. For corn, Isabela, Camarines Sur, and Cotabato make up the three provinces with the highest drop in production.

A notable point is that across these indicators, Region IV-A and V, and the province of Camarines Sur stand out as highly impacted localities on the absolute scale. Impacts of various climatic impact-drivers to this sector are highlighted in the table below.

Priority Adaptation Outcomes for Agriculture and Fisheries and Food Security

Grounded on national policies and existing programs related to this sector¹¹⁰, the adaptation theme for Agriculture and Fisheries and Food Security is **Securing Food Supply: Nurture Nature, Sustain Livelihoods**.

Three priority outcomes underpin this strategy:

1. **Productive and resilient agriculture and fisheries achieved.** This outcome focuses on the employment of best practices and technology to achieve optimal productivity of crops, livestock, and poultry farms, fishponds, and fisheries in anticipation of the effects of climate change and evolving consumption profiles, with an emphasis on food self-sufficiency. To achieve this outcome, more resilient farming practices must be adopted, supported by improved infrastructure and training programs.

¹¹⁰ Refer to Appendix 3 – Agriculture and Fisheries and Food Security to see list of policies and programs referenced as part of the NAP process



2. **Natural resources critical for agriculture, aquaculture, and fisheries conserved.** This outcome focuses on the development and implementation of a comprehensive set of monitoring, evaluation, and management programs and procedures to ensure Long-term (6+ years) viability of natural resources needed to sustain farms, fishponds, fisheries. For this outcome, agricultural and aquacultural practices that enable the conservation of natural resources and leverage organic methodologies must be encouraged across all levels, from farm to local government unit to national agencies.
3. **Farmers' and fisherfolk's livelihoods secured amidst climate change.** This outcome focuses on the implementation of adaptive strategies to safeguard workers and operations (e.g., supply chains) from the impacts of climate-related hazards. To achieve this outcome, support mechanisms for farmers and fisherfolk must be put in place across the value chain, from credit and financing to market linkages.

Prioritizing adaptation strategies that empower farmers and fisherfolk to improve their productivity, while at the same time preserving the natural resources they depend upon for the continuity of their production is key to ensuring the maintenance of domestic food production that most Filipinos depend upon. Well-enforced zoning and land protection policies, financial support systems and training programs, and accessible, localized climate data are all critical components to improve the security across agriculture, aquaculture, and fisheries in the Philippines.

Priority Adaptation Strategies for Agriculture and Fisheries and Food Security

Outcome 1: Productive and resilient agriculture and fisheries achieved.

Implementing Lead agencies: DA

Supporting agencies: DENR, DOST, DILG

Select Key Strategies	Brief Description	Implementation priority	Capital-intensiveness
Diversify and substitute crops, livestock, aquaculture	Diversification/rotation of crops, livestock, or aquaculture tested to ensure local adaptability, to de-risk specie-specific impact arising from climate change, building upon DA Climate Resilient Agriculture Office (CRAO) programs such as the Adaptation and Mitigation Initiative in Agriculture (AMIA) program	Immediate (0-3 years)	Low



Expand cold storage chains and facilities	Efficient storage infrastructure that reduces post-harvest losses and extends the shelf life of perishable produce in case of climate change disrupting supply routes, potentially supported by partnerships with organizations such as the Cold Chain Association of the Philippines (CCAP)	Immediate (0-3 years)	High
Improve aquaculture infrastructure	Improvements of hatcheries, grow-out ponds and other culture systems that are more resilient to extreme weather events such as aquashading technology	Immediate (0-3 years)	High
Improve feed varieties	Improvements on livestock & aquaculture feed varieties that are more cost-effective and sustainable	Immediate (0-3 years)	Medium
Drive adoption of urban farming	Cultivating crops and raising livestock in urban areas for local food production, supporting the enactment of the Urban Agriculture Law	Immediate (0-3 years)	Low
Develop and hold technical training programs for farmers and fisherfolk	Training programs to ensure farmers and fisherfolk are able to implement identified solutions, through channels such as Climate-Resiliency Field Schools (CFS)	Immediate (0-3 years)	Medium
Continue researching and establishing crossbred/ genetically improved species	After testing to ensure their adaptability, providing farmers with access to genetically enhanced, climate-adaptive and high-yielding crop, livestock, and aquaculture varieties, capitalizing on strains identified by Corn Germplasm Utilization through Advanced Research and Development, PhilRice, and private biotech firms	Long-term (6+ years)	High


Outcome 2: Natural resources critical for agriculture, aquaculture, and fisheries conserved

Implementing Lead agencies:	Supporting agencies:
DA	DENR, DOST, DILG, DHSUD

Select Key Strategies	Brief Description	Implementation Priority	Capital-intensiveness
Improve soil health management programs	Improvement of soil testing and application of corresponding soil amelioration measures to respond against diminished soil health from climate change, building upon DA-BSWM's National Soil Health Program (NSHP)	Immediate (0-3 years)	Medium
Improve and expand integrated pest management programs	Implementation of pest control strategies amidst potential infestations that may arise due to climate change that minimize pesticide use and incorporate natural predators and biological controls, expanding and improving on programs such as Pest Risk Identification and Management Efficiency (PRIME) and the Program for Bantay-Peste Brigade and Management (PBBM)	Immediate (0-3 years)	High
Promote adoption of efficient irrigation techniques	Promotion of drip irrigation, alternate wetting / drying, and other efficient irrigation methods that reduce water wastage, building on initiatives such as Water Efficient and Risk Mitigation Technologies (WateRice), Water Balance-Assisted Irrigation Decision Support System (WAISS), aligned with the National Irrigation Masterplan 2020-2030	Immediate (0-3 years)	Medium
Improve dissemination of precision agriculture and aquaculture	Utilization of technology and data analysis to optimize farming practices, minimizing waste and resource use while maximizing crop yield and sustainability, leveraging facilities such as the Precision and Digital Agriculture Center	Immediate (0-3 years)	High



Encourage sustainable farming and fisheries management	Sustainable management and conservation of agricultural and fishery resources that preserves health of terrestrial and marine ecosystems at the same time	Immediate (0-3 years)	High
Strictly enforce agro-aqua ecological zoning measures	Enforce ongoing efforts such as the Network of Protected Areas for Agricultural and Agro-Industrial Development (NPAAAD) and Strategic Agriculture and Fisheries Development Zones (SAFDZ) Maps, and the National Land Use Act within localities through mechanisms such as regular audits, robust monitoring systems (being built by DHSUD), dedicated enforcement teams, and penalties	Long-term (6+ years)	Medium
Continue sustainable agriculture, aquaculture, and fisheries R&D	Conducting of research on sustainable farming practices, such as soil conservation, water-efficient irrigation, climate-resilient crop varieties, circular farming and aquaculture, and integrated mangrove aquaculture systems, both new and building on existing programs such as PhilRice - Community-Based Participatory Action Research on Climate (CPAR), as well as farmer-led research	Long-term (6+ years)	High

Outcome 3: Farmers' and fisherfolk's livelihoods secured amidst climate change

Implementing Lead agencies: DA	Supporting agencies: DENR, DOST, DOLE, DILG, DOF

Select Key Strategies	Brief Description	Implementation Priority	Capital-intensiveness
Expand and support farmer cooperatives and networks	Operationalization of adaptation-focused programs for the protection of labor rights and facilitation of knowledge sharing, collective decision-making, and access to resources, technologies, and markets expanding on	Immediate (0-3 years)	Medium



	initiatives such as Climate-Resiliency Field Schools (CFS)		
Develop localized early warning systems & info dissemination	Developing localized early warning systems and communication channels that consider regional climate pattern, crop- and fish-specific risks such as "ISDApp: The App for the Fishing Community" co-developed by Globe, iNON IT Solutions, NFRDI and BFAR, and larger scale programs such as Smarter Approaches to Reinvigorate Agriculture as an Industry (SARAI)	Immediate (0-3 years)	Low
Improve climate insurance	Insurance against extreme weather events made affordable through methods such as government subsidization to allow farmers and fishers to maintain business continuity despite such events e.g., Philippine Crop Insurance Corporation, as well as new financing models such as private financing	Immediate (0-3 years)	High
Train small holder farmers and fisherfolk, promote agricultural best practices	Promotion of climate resilient agri practices, training on sustainable water and soil management, reinforcing programs such as S&T Community-based Program for Inclusive Development (STC4ID) or Climate-Resiliency Field Schools (CFS), while also disseminating best practices for occupational safety and maintenance of health amidst climate change for farmers and fisherfolk	Immediate (0-3 years)	Medium
Conduct climate risk vulnerability assessments (CRVA)	Conduct of risk, vulnerability and suitability assessment of crop and fishery commodities and communities to climate change for planning and monitoring purposes at various levels and scales using developed tools e.g., CRVA, eVSA and FishVool	Immediate (0-3 years)	Medium



Establish and facilitate market linkages for small holder farmers and fisherfolk	Facilitate access to downstream market actors for smallholder farmers and fisherfolk through mechanism such as contract farming and farm and fish markets, enabling more value capture leading to strengthened resiliency amongst smallholder farmers and fisherfolk	Immediate (0-3 years)	High
Improve provision of smallholder credit and financing programs	Provide accessible and affordable financial support to empower smallholder farmers and fisherfolk to adopt adaptive and resilient practices and technologies, building on programs such as the Agricultural Credit Support Project, Agrarian Production Credit Program, or the Sikat Saka Program, as well as various agricultural financing programs provided by the Agricultural Credit Policy Council (ACPC) such as the Kapital Access for Young Agripreneurs (KAYA) Loan Program; Agri-Negosyo (ANYO) Loan Program; and Expanded SURE Aid and Recovery Project (SURE COVID-19) for Micro and Small Enterprises (MSEs)	Immediate (0-3 years)	High
Expand economic incentives, subsidies for climate resilient farming	Provision of financial incentives and subsidies for farmers and fishers adopting climate-resilient practices	Medium-term (3-6 years)	High



4.2.2 Water resources

Overview of Water Resources in the Philippines

The security of Water Resources is a priority of utmost importance to the Philippines, evident from its inclusion in both the Philippine Development Plan (2023-2028) and the National Climate Change Action Plan. The sector is deeply intertwined with industries, health, agriculture, and ecosystems. From an economic standpoint, water is a key input that fuels economic growth across the agriculture and industry sectors – these two sectors make up over 90% of the country's water consumption profile. Socially, water is a necessary resource for drinking, sanitation, and hygiene practices, thus key for human survival. As such, access to safe and clean water is considered fundamental for human health and well-being, and well-planned water infrastructure is a key enabler to achieving this.

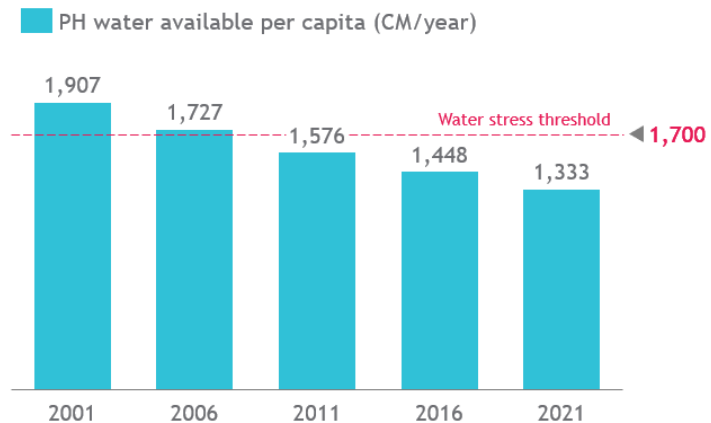


Figure 4.2.2.1. Water availability per capita, 2001-2021

The Philippines faces a myriad of challenges that hinder the provision of safe and affordable water across its localities. While a study done in 2001 found that the Philippines had 1,907m³ of water available per capita per year, the rapid population growth that the nation has undergone will have pushed that number down to an annual amount of 1,333m³ per capita, well below the threshold for water stress of 1,700m³ per capita (see Figure 4.2.2.1).

These challenges manifest themselves institutionally as well. Until the recent creation of the Water Resources Management Office in April 2023, there were over 30 water-related agencies without clear boundaries of ownership, leading to weak institutional execution. Additionally, according to the Philippine Development Plan (2023-2028), there is a lack of data and monitoring programs of water resources to provide agencies and organizations with the proper information to guide decisions. Finally, there is inadequate inventory, planning, management, and financing of the Philippines's water infrastructure network, hindering its expansion, rehabilitation, and maintenance.

Climate Change Impacts on Water Resources

The current state of Philippine water supply and quality, combined with its water infrastructure network make the nation's water resources particularly vulnerable to climate change. The Philippines faces varied rainfall patterns across geographies and seasons – according to the Philippine Water Supply and Sanitation Master Plan, NCR, CALABARZON, and Region VII face absolute water scarcity.

This variation in water security can be remedied with a well-developed infrastructure network of water storage, distribution, sanitation, and consumption systems, which is lacking in the current Philippine



water system. For example, as of 2015¹¹¹, over 12% of Filipinos relied on water sources classified as unsafe, such as undeveloped wells, lakes, or rivers, while over a quarter of the population did not have access to safely managed sanitation.

Additionally, aging and outdated infrastructure, such as the majority of irrigation systems in the Philippines, are particularly vulnerable to climate impacts. Open irrigation ditches or canals, which are most used today are susceptible to leakage, while open canals are at risk of reduced capacities stemming from sedimentation – the Philippine Development Plan (2023-2028) estimates that proper water management in farms could lead to 25% reduction in consumption, which equals to approximately 22% of the total water consumption profile in the Philippines.

More extreme climate conditions and events are projected to exacerbate the highlighted issues amongst Philippine water resources. Drier dry seasons are likely to worsen the conditions across localities already experiencing symptoms of water stress. On the other hand, wetter wet seasons and more intense cyclones damage may damage water infrastructure – for example, in 2009, Typhoon Ketsana's impact on water infrastructure led to a 92% decrease in water supply capacity. The table below highlights the negatives of other climatic impact-drivers on Water Resources.

Table 4.2.2.1. Impacts of climate hazards on Water Resources

Climatic driver	impact-	Impacts to Water Resources sector
Increased temperature Drought	and	Algal blooms impacting water quality Higher temperatures enhance nutrient cycling and availability in water bodies, providing favorable conditions for algal growth. Warmer temperatures accelerate algal metabolism, leading to increased growth rates and proliferation of certain algal species, leading to decreased water clarity from oxygen depletion and toxin production, as well as proliferation of pathogenic bacteria, potentially impacting the freshwater aquaculture and water distribution industry. Decreased water supply Increased temperature can lead to the drying up of water sources in the Philippines, resulting from changes in precipitation patterns, evaporation rates, and soil moisture levels. Rising temperatures contribute to higher rates of evaporation, causing water bodies, such as rivers, lakes, and reservoirs, to lose water more rapidly. The reduced water availability can have adverse effects on various sectors. Additionally, prolonged droughts can deplete groundwater reserves, further exacerbating water scarcity. Higher temperatures associated with drought intensify evaporation rates, leading to additional water loss. Increased concentration of water pollutants

¹¹¹ National Economic and Development Authority. (2021). Philippine Water Supply and Sanitation Master Plan



	Reduced water flow during drought periods can result in the accumulation of pollutants, such as sediments, nutrients, and contaminants. Drought conditions can lead to increased water salinity and changes in pH levels, impacting water quality parameters, potentially impacting a wide range of industries such as freshwater aquaculture, agriculture, tourism, and water distribution players.
Sea level rise and extreme sea levels	Saltwater intrusion Rising sea levels push saltwater inland, contaminating freshwater sources such as rivers, estuaries, and groundwater. Contaminated freshwater becomes unsuitable for drinking, irrigation, and other essential uses, leading to a scarcity of safe water supply. Damaged water infrastructure Sea level rise renders coastal water infrastructure, such as pumping stations, treatment plants, and distribution networks, more vulnerable to damage from storm surges and coastal erosion. Increased exposure to saltwater can accelerate infrastructure deterioration and increase the risk of failures.
Extreme precipitation	Flooding leading to contamination of water supply Heavy rainfall can cause excessive surface runoff or overflowing of water bodies, resulting in the inundation of water sources and water treatment facilities. This can lead to the contamination of water supplies with pollutants, sediments, and pathogens. Floodwater can also pick up chemicals, waste, and debris, further contributing to water contamination, potentially impacting a wide range of industries such as freshwater aquaculture, agriculture, tourism, and water distribution players. Damaged water infrastructure Extreme precipitation events can cause damage to water infrastructure, including pipelines, pumping stations, treatment plants, and storage facilities. Floodwaters, strong currents, and landslides can lead to the physical destruction of infrastructure, disrupt water distribution networks, and result in service interruptions.
Wind patterns and tropical cyclones	Damaged water infrastructure Wind patterns and tropical cyclones can cause physical damage to water infrastructure, including pipelines, pumping stations, treatment plants, and storage facilities. This damage disrupts the water supply and distribution systems, resulting in service interruptions. Contaminated water supply



	Cyclones and strong winds contribute to water source contamination. Heavy rainfall associated with typhoons causes runoff, carrying pollutants into rivers, lakes, and reservoirs. Contaminants include sediment, chemicals, and pathogens, rendering water unsafe for consumption, potentially impacting a wide range of industries such as freshwater aquaculture, agriculture, tourism, and water distribution players.

More intense drought or lack of rainfall potentially reduces water supply in certain localities¹¹². Precipitation models in Chapter 3.3 projected a reduction in total precipitation across northeastern Luzon and south Mindanao. This scarcity is particularly pronounced in regions such as in Region VII, which is expected receive over 400mm less rainfall per year in the decade of 2030 compared to 1991-2020. Already facing a combination of an absolute scarcity level of water availability per capita (397 m³/capita/year), and more than a third of its population without access to a safe water source¹¹³, the implication here is the need for more resilient water infrastructure to be built here to ensure its communities' secure, safe, and sustainable access to water resources.

Additionally, pluvial flooding and cyclones are expected to damage water infrastructure across the nation. Across the decade of 2030-2040, almost 10% of water infrastructure, composed of water tanks and towers, dams, and treatment plants, are projected to be exposed to pluvial floods and cyclones. The direct damages caused by these climate hazards is expected to stand at over 11B PHP annually from 2030-2040, with more than half of the damage generated within Regions III and IV-A.

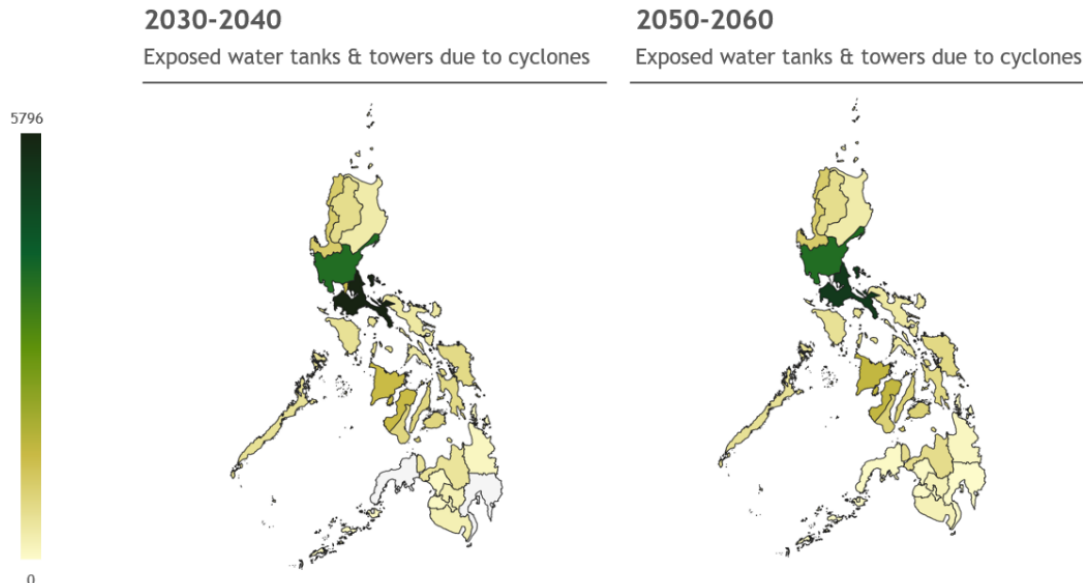


Figure 4.2.2.2 Water tanks and towers exposed to cyclones, 2030-40, 2050-60, SSP 5-8.5

¹¹² Quantitative climate impacts outlined in this chapter are projected based on climate models developed as part of the National Adaptation Plan process. Detailed methodology for climate models per sector can be viewed on Appendix 2 and Appendix 3 – Water Resources

¹¹³ National Economic and Development Authority. (2021). Philippine Water Supply and Sanitation Master Plan

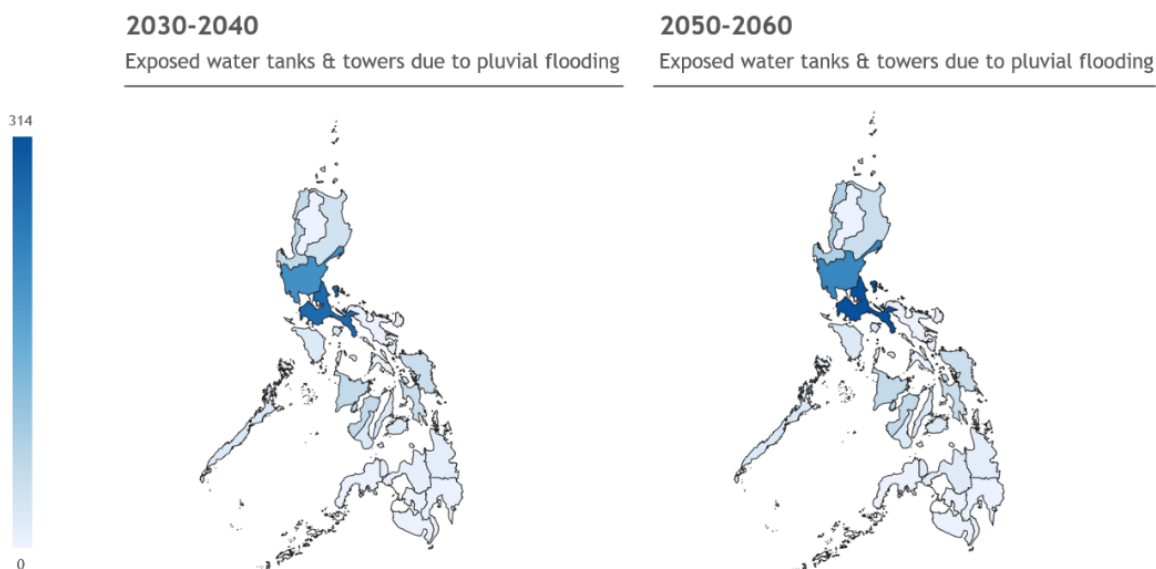


Figure 4.2.2.3 Water tanks and towers exposed to pluvial flooding, 2030-40, 2050-60, SSP 5-8.5

Priority Adaptation Outcomes for Water Resources

Grounded on national policies and existing programs related to this sector¹¹⁴, the adaptation theme for Water Resources is **Safeguard Water Security: Secure and Sanitary Water for All**.

Three priority outcomes underpin this strategy:

1. **Resilience built into water infrastructure.** This outcome focuses on building resiliency within new and existing water infrastructure aligned with comprehensive, updated structural standards and integrated planning. To attain this outcome, a proper inventory of existing infrastructure will be required, supported by a robust governance and implementation process to drive the implementation of strategies.
2. **Water supply and quality protected from shifts in weather patterns.** This outcome focuses on the augmentation of existing water supply with additional conventional and alternative sources where climate change is projected to affect the water balance, while managing demand and quality standards. Due consideration will be given to future trends in the distribution, frequency, and intensity of hydrometeorological events compared to historical trends. For this outcome, private sector should be involved, where possible, and the mobilization of financing to continue programs aspiring to provide safe and sustainable water to communities should be implemented, incorporating learnings from initial rollouts.
3. **Watersheds and surrounding ecosystems protected and properly managed.** This outcome focuses on the focused efforts on active planning and management of Philippine watersheds and

¹¹⁴ Refer to Appendix 3 – Water Resources to see list of policies and programs referenced as part of the NAP process



surrounding ecosystems to ensure their capacity to serve as a reliable water source. To achieve this, an understanding of the current state of watersheds must be attained, followed by well-enforced policies and programs related to land use planning and forest, agriculture, and urban development to ensure the longevity of these water sources.

Prioritizing adaptation strategies that ensure resilient water infrastructure which enables the provision of safe, affordable, and secure water will help ensure individuals' health and sanitation amidst climate change, and at the same time provide key industries with the water needed to operate in a sustainable manner. A governance structure with clear roles and ownership, operating in line with an updated Water Code is needed to oversee initiatives such as inventory and profiling programs to set a baseline when making decisions on future programs to implement, as well as to mobilize sufficient funding to execute, whether from the government or from private or multilateral sources.

Priority Adaptation Strategies for Water Resources

Outcome 1: Resilience built into water infrastructure	
Implementing Lead agencies: DENR	Supporting agencies: DPWH, DOST, DND, DILG

Select Key Strategies	Brief Description	Implementation Priority	Capital-intensiveness
Implement Early Warning Systems for water infrastructure	Implementing tool to predict potential issues such as water shortages/ contamination/ infrastructure damage due to climate change prior to major consequences – build upon existing programs such as PAGASA advisory to LGUs & NGAs on water allocation and safety on a river basin/ watershed level	Immediate (0-3 years)	Low
Reassess water infrastructure building codes	Reviewing and updating water infrastructure building codes based on forecasted local climate hazard impact	Medium-term (3-6 years)	Medium
Improve resiliency of existing water infrastructure	Retrofitting and upgrading to achieve piped, treated, utility-managed surface water systems with interventions such as filters ensure protection of water infrastructure – geographical expansion of practices such as MMDA's operation and maintenance of various flood control structures, facilities, equipment, dams, and waterways, DOST-	Medium-term (3-6 years)	High



	PAGASA's Rehabilitation of Septage & Sewerage systems program		
Implement zoning and land use and other regulatory policies such as dam releases to reduce risk to water infrastructure and surrounding communities	Implementing zoning regulations and land-use planning measures that consider climate risks along with conservation of biodiversity, soil, water, and other ecosystem services	Medium-term (3-6 years)	High

Outcome 2: Water supply and quality protected from shifts in weather patterns

Implementing Lead agencies: DENR	Supporting agencies: DPWH, DILG, DOH

Select Key Strategies	Brief Description	Implementation Priority	Capital-intensiveness
Ramp up rainwater harvesting programs	Ramp up utilization programs of rainwater as an alternative water source to ensure continued access to water supply amidst climate change, such as DOST-PAGASA's construction of Rainwater Collectors, and DPWH's installation of Rainwater Harvesting System (RWHS)	Immediate (0-3 years)	High
Expand wastewater treatment facilities	Expand on the improvement of water quality and reusing of wastewater as an alternative water source to ensure continued access to water supply amidst climate change	Immediate (0-3 years)	High
Install and expand strategic water supply mechanisms for remote areas	Install water storage tanks, water impounding facilities, small farm reservoirs, and cisterns in strategic locations where conventional water supply unavailable such as mountainous/upland areas to ensure continued access to water supply amidst climate change, building upon	Immediate (0-3 years)	High



	programs such as the Sagana at Ligtas na Tubig para sa Lahat (SALINTUBIG) program, or supporting transition of water providers to grid-tied systems		
Augment public water supply and quality infrastructure	Mobilize investments to expand water storage facilities (e.g., dams, reservoirs, water tanks, water towers) as well as treatment and distribution systems (e.g., sewers, treatment plants) to ensure continued access to water supply amidst climate change for the general public	Immediate (0-3 years)	High
Review, develop, and update water pollution control regulations	Develop and update existing regulations that require industries, agriculture, aquaculture, and other potential polluters non-point sources of pollution to adopt pollution control measures such as limits on pollutant discharges, wastewater treatment requirements, environmental users fee system, etc.	Immediate (0-3 years)	High
Review and update water quality standards and guidelines	Review and update regulatory frameworks that define the acceptable levels of various pollutants and contaminants in water bodies, in anticipation of future climate trends and their impact on the physical and chemical properties of our water bodies, building on initiatives such as Water Quality Management Areas (WQMA), should facilitate the adoption of innovative strategies for adaptation and mitigation in the implementation of clean water regulations	Immediate (0-3 years)	Medium
Run training programs on water management and conservation techniques	Training/education sessions ranging from water management programs for farmers, industrial and energy players to conservation programs for households to build resiliency amongst water consumers	Immediate (0-3 years)	Medium
Establish water markets and tariffs control regulations	Implementation of market-based mechanisms and pricing structures to promote efficient water use and incentivize conservation, such as consequences for unregulated	Medium-term (3-6 years)	Medium



	groundwater extraction, informed by information from programs such as NWRB's Water Resources Supply and Demand Assessment		

Outcome 3 Watersheds and surrounding ecosystems protected and properly managed

Implementing Lead agencies: DENR	Supporting agencies: DILG, NCIP, DA

Select Key Strategies	Brief Description	Implementation Priority	Capital-intensiveness
Enhance integrated watershed management	Development of integrated management plans for all watersheds and used as the integrated framework for comprehensive land use planning and development of sectoral development plans of LGUs to ensure watershed resiliency amidst climate change	Immediate (0-3 years)	Medium
Establish riparian buffers	Vegetated buffer zones along water bodies that protects water quality from contamination stemming from climate change	Immediate (0-3 years)	High
Perform profiling of critical water source	Identifying and assessing all watersheds and river basins for proper monitoring & evaluation and management, across both surface water supply such as NWRB's Comprehensive Water Resource Assessments (CWRA) for Major River Basins (MRB), DENR-MGB's Groundwater Resource and Vulnerability Assessment, and nuclear analytical techniques and stable isotopes profiling of the DOST PNRI	Immediate (0-3 years)	High
Regulate development activity impacting watersheds	Implementing rules and regulations to manage development in areas that might impact watersheds to ensure the preservation of their adaptive potential	Medium-term (3-6 years)	Medium



Regulate inappropriate developments in floodplains	Restrict inappropriate development in flood-prone areas, ensuring floodplains are properly utilized and their resiliency is maximized	Medium-term (3-6 years)	Medium



4.2.3 Health

Overview of Health in the Philippines

Health is fundamental to the transformation goals of AmBisyon Natin 2040 and underpins the Philippines' socioeconomic agenda. The country envisions Filipinos across the country to be able to enjoy longer and healthier lives and be provided undisrupted access and financial protection to quality health services. From an economic perspective, resilience in the health sector acts as a form of economic insurance, helping to mitigate economic impacts of health crises exacerbated by climate change. Proactive measures to climate-proof health systems minimize the disruption of emergency healthcare interventions in times of extreme weather events.

From a social standpoint, investments in health are investments in the protection of our most vulnerable and marginalized populations. Ensuring that populations have access to consistent and quality healthcare services promotes social equity and reduces disparities in health outcomes. Moreover, a resilient health sector displays a strong ability to address social determinants of health such as economic stability, education, and social and community context.

Despite major health sector reforms and plans in the past decade, this sector continues to face challenges relating to healthcare resource capacity, financial protection, and equitable access to healthcare services. The fragmented nature of the Philippine health sector is hampering coordinated planning across private and public health systems. Within public health, there continues to be high variations across local government units in terms of health priority, with a disproportionate amount of resources invested in treatment, rather than prevention. In addition, there are sustained and growing gaps in both the absolute number and the inequitable distribution of health infrastructure and healthcare resources across the Philippines, typically with insufficient provision in areas with the greatest need for health care. As a result, the longstanding inequality embedded in the Philippines' health system makes it more challenging to plan for the long-term against climate change impacts.

Climate Change Impacts on Health

Key vulnerabilities emerge in relation to the Philippines' ability to achieve targeted health outcomes considering climate change impacts. First, the Philippine health system continues to face resource limitations, especially across medical personnel and essential supplies. For example, in 2020, only 56% of public health facilities are sufficiently stocked with selected essential medicines¹¹⁵, and less than 25% of cities and municipalities have health human resource density

¹¹⁵ Philippine Statistics Authority. (n.d.). OpenStat: Sustainable Development Goals (Goal 3. Ensure healthy lives and promote well-being for all at all ages, 3.b.3.p1 Percentage of public health facilities properly stocked with selected essential medicines) [Dataset]. https://openstat.psa.gov.ph/PXWeb/pxweb/en/DB/DB__3I__G03/023313D3B31.px/table/tableViewLayout1/?xid=8ea3c28a-e5f9-4fee-888e-dfebffd616e8



above the 41 physicians, nurses and midwives per 10,000 population recommended by the World Health Organization¹¹⁶.

These constraints hinder the sector's ability to respond effectively to sudden and increased healthcare demands resulting from climate-related risks. This challenge became evident during the onset of the COVID-19 pandemic in 2020, as abrupt surges in healthcare needs critically strained the Philippine health system's resources. Drawing key learnings from the pandemic experience, the health sector has initiated efforts to enhance its responsiveness to unforeseen scenarios. Moving forward, there is an opportunity to proactively prepare for health resilience, with a specific focus on the implications of climate change to health.

Second, primary healthcare facilities in the Philippines are not built to withstand extreme climate events such as typhoons, floods and landslides. These barangay health centers serve as frontline health facilities for the population (e.g., 18 available per every 100,000 population in BARMM¹¹⁷), especially in low GDP regions such as BARMM that have limited access to large healthcare facilities (e.g., 0.95 hospitals per every 100,000 population vs. NCR's 1.1 hospitals per every 100,000 populations). These primary care facilities are jeopardized during unforeseen climate events and further weaken an already weak primary care system, with limited sector-wide strategies to protect against such risks.

Lastly, there remains inadequate social health insurance support that ensures affordability of healthcare for all Filipinos. Household out-of-pocket expenditures remain at 50%, even after 40 years of existence of Philippine Health Insurance Corporation (PHIC). As climate impacts increase, a more robust healthcare financing system will be necessitated to ensure Filipinos have affordable access to healthcare.

Climate change has both direct and indirect impacts on human health. Directly, exposure to extreme weather events may result in increased incidences of vector-borne diseases, waterborne diseases, and heat-related illnesses. Proliferation of dust particles and pollutants due to air pollution and emergence of allergens may also worsen health issues for populations with comorbidities. Indirectly, nutrition of populations may be compromised due to losses in agricultural land and changes in fish catch.

Climate change compounds the threats posed to the stability of health systems, and thus, potentially disrupting access of health services for all Filipinos. The health system already faces constraints that impact its ability to provide equitable healthcare: interrupted service delivery, insufficient capacity of the health workforce, non-interoperable health information systems, limited financing, and disconnected health governance. Climate-induced migration may also increase demand for healthcare services and strain health systems in select areas where unforeseen migration occurs. Insufficient preparation to ensure the resilience of health systems will hinder the ability to minimize mortality amidst climate impacts.

The table below highlights the negative effects of climatic impact-driver on this sector.

¹¹⁶ Panay News. (2023, August 13). Maldistribution of healthcare workers. Philippine Institute for Development Studies. Retrieved August 11, 2023, from <https://www.pids.gov.ph/details/news/in-the-news/maldistribution-of-healthcare-workers>

¹¹⁷ Department of Health. (n.d.). Department of Health National Health Facility Registry (V3.0) [Dataset]. <https://nhfr.doh.gov.ph/>



Table 4.2.3.1. Impacts of climatic impact-drivers on Health

Climatic impact-drivers	Impact to Health
Sea level rise and extreme sea levels	Water-related diseases from salinity intrusion and contamination As seawater intrudes into freshwater sources, salinization occurs, compromising the quality of drinking water. This impacts the health of communities reliant on freshwater supplies. Contaminated or polluted water also increases the risk of water-related diseases including cholera. Damaged health infrastructure Extreme weather events, exacerbated by sea level rise, can damage healthcare facilities and disrupt access to medical services, putting people at risk and causing delays in delivery of health services, thus exacerbating health issues. Loss of human lives and mental disorders Rising sea levels lead to coastal erosion and the submergence of low-lying areas, resulting in immediate loss of shelter and livelihoods and potential displacement of communities. This displacement can cause psychological distress, trauma, and loss of a sense of place and cultural identity.
Extreme precipitation	Risk for physical injuries and exposure to water-related illness e.g., cholera and leptospirosis Extreme rainfall leads to heavy flooding, which in turn leads to injuries, drowning, and waterborne diseases. Contaminated floodwater increases the risk of gastrointestinal illnesses, skin infections, and leptospirosis. Contamination of water supply Pollutants from submerged waste dumps may also contaminate water supplies. Expansion of breeding grounds for vector-borne diseases Wet and humid conditions are ideal mosquito breeding conditions which increases likelihood of spread of vector-borne diseases e.g., dengue and malaria.
Wind patterns and tropical cyclones	Injuries and fatalities Cyclones and extreme winds can cause physical injuries (e.g., cuts, bruises, fractures), and fatalities due to the collapse of structures, flying debris, and/or drowning. People with chronic diseases are at risk for death during severe typhoons due to interrupted access to medical facilities. Exacerbated mental health impacts Experiencing destruction of homes, loss of loved ones, or sudden displacement from communities due to tropical cyclones can lead to post-traumatic stress disorder (PTSD) and worsen existing anxiety disorders.
Increased temperature and droughts	Expansion of breeding grounds for vector-borne diseases Increased temperatures may also result in changes in patterns of breeding conditions of mosquitoes which increases likelihood of spread of vector-borne diseases. Increased incidences of heat stroke and cardiovascular stress



	Extreme heat may potentially worsen conditions like hypertension and increase the risk of heart attacks and other cardiovascular diseases. Compromised food supply and nutrition Extreme heat can lead to drought conditions on agricultural crops and compromise health of livestock, which in turn can have significant impacts on food supply and nutrition.

Among the various climatic-impact drivers, pluvial flooding¹¹⁸ is a key climate risk that threatens health infrastructure and networks¹¹⁹. Pluvial flooding can damage roads, bridges, and other transportation infrastructure, making it difficult for healthcare providers, patients, and medical supplies to access healthcare facilities. As a result, populations will experience delays in receiving medical care, which are especially crucial in emergencies. In decade 2030, a projected 8% of critical healthcare infrastructure, including hospitals, medical centers and pharmacies¹²⁰, will be exposed to pluvial floods, with an estimated 24% of facilities in CAR exposed. Annualized damage of critical healthcare infrastructure nationally could potentially reach PHP 610 million in damages per year just from pluvial floods. Accounting for impacts of other climatic-impact drivers beyond pluvial floods, an additional PHP 495 million in damages per year may potentially be incurred on healthcare infrastructure.

In the following decade, healthcare infrastructure in other regions may also be exposed. In decade 2050, a projected 10% of critical healthcare infrastructure will be exposed to pluvial floods. In CAR, Region IV-B and Region IV-A, more than 20% of facilities¹²¹ are projected to be exposed to pluvial flooding.

¹¹⁸ Pluvial, fluvial and extreme sea level-driven floods are modelled on a 10-year return period, represented by flood heights with a 10% chance of occurring in a year

¹¹⁹ Quantitative climate impacts outlined in this chapter are projected based on climate models developed as part of the National Adaptation Plan process. Detailed methodology for climate models per sector can be viewed on Appendix 2 and Appendix 3 - Health

¹²⁰ Data does not exhaustively include all health centers e.g. frontline facilities such as barangay health centers and rural health centers

¹²¹ Same as above

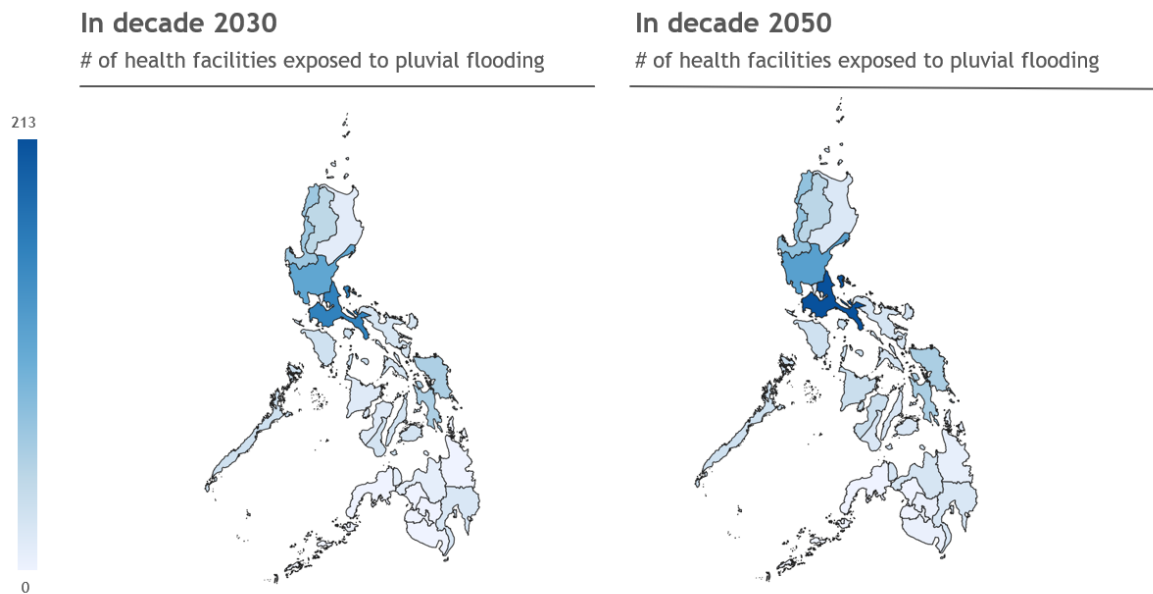


Figure 4.2.3.1. Number of health facilities exposed to pluvial floods in decade 2030 and decade 2050¹²²

Extreme sea levels are also projected to significantly damage critical health infrastructure. While less health infrastructure is exposed to extreme sea levels (7%), the potential damage cost incurred is larger at an estimated PHP 490 million in damages per year due to height of flooding.

Extreme precipitation due to tropical storms is also expected to increase incidences of climate-related diseases in the next few decades. Leptospirosis and dengue fever are among the most critical climate-related diseases facing the Philippines, provided the high volume of dengue cases and the high death rate from leptospirosis. A correlation analysis of environmental determinants was thus used to estimate change in incidences of leptospirosis and dengue.

¹²² “In decade 2030” refers to 1 in 10 yr return period events in 2030-2040 and “In decade 2050” refers to 1 in 10 year return periods events in 2040-2060

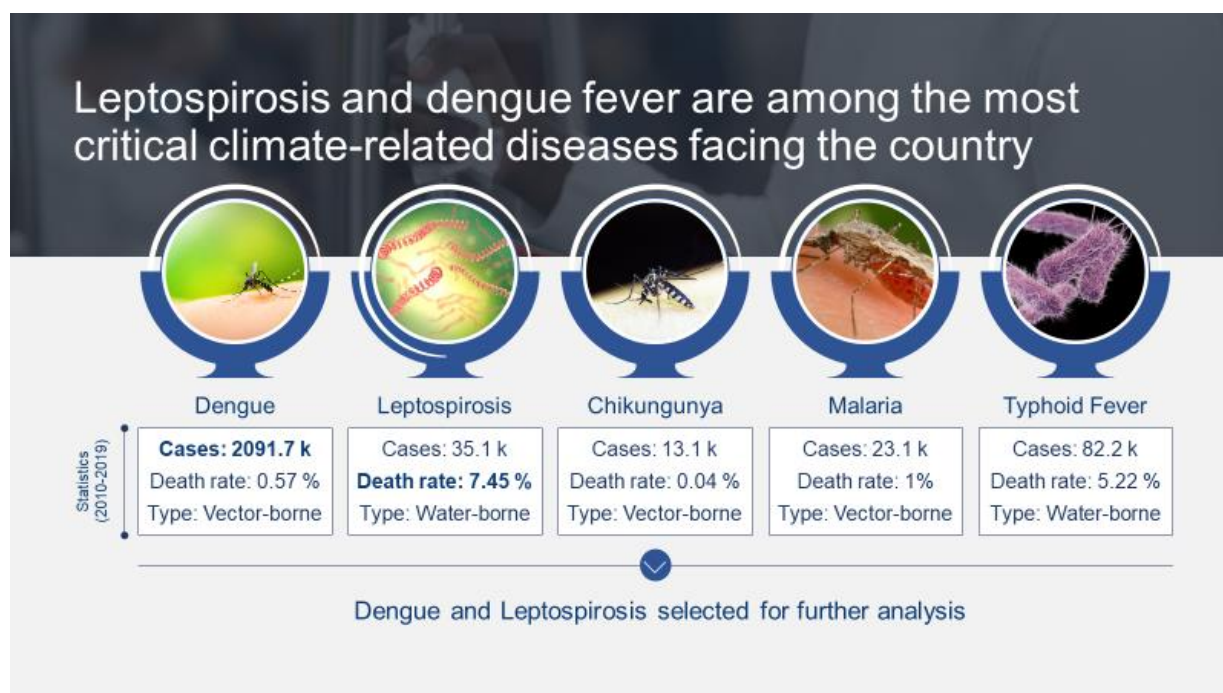


Figure 4.2.3.2. Various vector-borne and water-borne climate-related diseases present in the Philippines

Contaminated or polluted water brought about by poor drainage systems after heavy rainfall may contribute to increases in leptospirosis incidence in the 2030 decade, projected to grow by 58% versus historical incidences¹²³. Geographically, Region VI (0.12‰), NCR (0.10‰) and Region III (0.09‰) are expected to have the highest incidence rate relative to population. This is in line with historical trends, as well as due to the large population size and high population density living in informal settlements. However, it is also critical to protect Region X and Region XVIII, given projections estimate 2-3x increase in annual cases of leptospirosis in the 2030 decade despite a low historical base.

¹²³ 2010 to 2019 historical annual cases

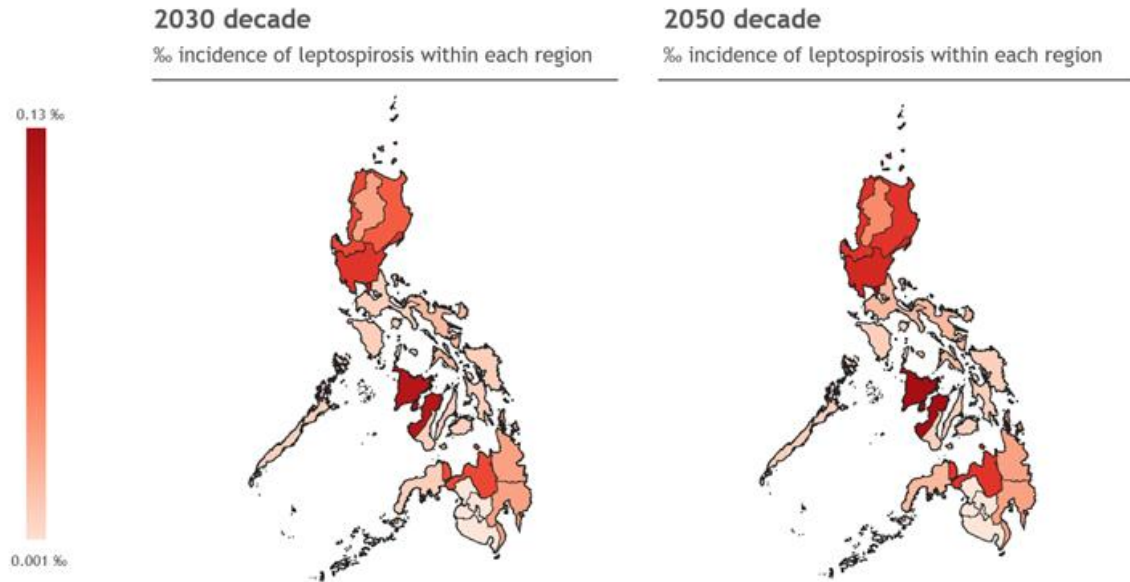


Figure 4.2.3.3. ‰ leptospirosis incidences for 2030 decade and 2050 decade

	Group 1 Growth rate > National growth rate (58%)	Group 2 Growth rate < National growth rate
High historical base of annual leptospirosis cases (>206 cases/year)	Region X Region VIII Region XIII	NCR Region I
Low historical base of annual leptospirosis cases (<206 cases/year)	Region VI Region III	Region IV-A Region XI Region V Region VII CAR Region IV-B Region XII BARMM Region II Region IX

Table 4.2.3.2. Philippine regions grouped by projected growth rates of leptospirosis cases for 2030 decade against historical annual leptospirosis cases (2010-2019)

On the other hand, warmer temperatures and altered precipitation patterns can expand the geographic range of dengue-carrying mosquitoes. Changes in climate can also lead to shifts in the timing and duration of seasons, affecting mosquito populations and dengue transmission patterns. While dengue incidences are projected to stabilize at a national level (8% decrease in total number of annual cases versus historical), dengue incidences in some regions are expected to grow in the 2030 decade. For example, projected incidence rates for dengue in CAR (4.71%) and Region XIII (3.42%) will be higher



than national average, when historically these had been regions that had a low historical base of dengue incidences. Consequently, it will be critical to accelerate dengue prevention and control efforts in select regions where annual incidences are still expected to grow, including BARMM (171% increase) and Region V (131% increase), potentially overwhelming health systems available.

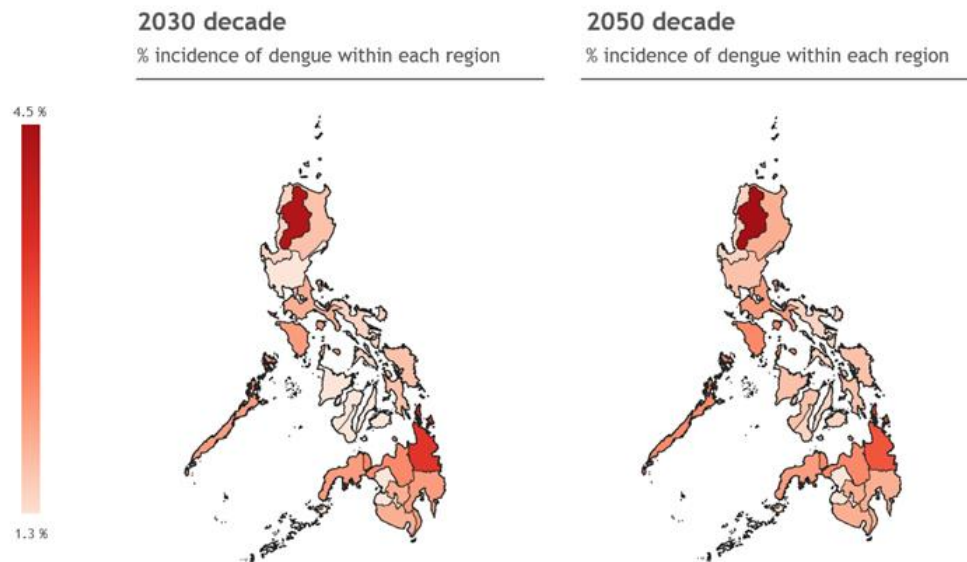


Figure 4.2.3.4. % dengue incidences for 2030 decade and 2050 decade

	Group 1 Growth rate > National growth rate (-8%)	Group 2 Growth rate < National growth rate (-8%)
High historical base of annual dengue cases (>14k cases/year)	Region IV-A NCR	Region III Region VII Region X Region VI
Low historical base of dengue leptospirosis cases (<14k cases/year)	Region XI Region V Region XIII CAR Region IV-B BARMM	Region XII Region I Region IX Region VIII Region II

Table 4.2.3.3. Philippine regions grouped by projected growth rates of dengue cases for 2030 decade against historical annual dengue cases (2010-2019)

When considering priority adaptation solutions for the sector, actions must be taken to protect the most vulnerable populations: elderly, rural, women, children, indigenous communities, marginalized low-income communities and various subgroups of persons with disabilities, who may have limited access to healthcare facilities. Action must be taken to ensure resiliency of health services in extending services to remote rural and indigenous communities, raising awareness about disease prevention and preparedness, and providing support to older adults living in isolation



or in remote areas. In addition, a rights-based approach must be taken when viewing the needs and circumstances of persons with disabilities.

Priority Adaptation Outcomes for Health

Built on the vision of activating a holistic approach to improve health outcomes, reduce health inequalities, and achieve universal healthcare and supported by current programs and policies¹²⁴ that help address social determinants of health, the adaptation theme for Health is **Climate-Adaptive Healthcare for All: Protecting Health & Well-Being of Filipinos**.

Four priority outcomes underpin this strategy:

1. **Minimized patient mortality from climate-sensitive diseases through reinforced primary care and reinforced community health workers.** This outcome focuses on reinforcing accessibility, availability and affordability of primary health care for all, and enables health workers to effectively diagnose, treat, and manage climate-related health challenges. For this, dedicated policy and funding support must be activated to build up a cadre of health workers who are able to respond anytime and anywhere. Unlocking and upskilling health workers will allow for responsive healthcare delivery, even at the most microscale level of healthcare.
2. **Seamless access to climate-responsive health services underpinned by resilient health networks.** This outcome focuses on ensuring equitable access to healthcare for all Filipinos through enhanced preparedness across public and private health networks for climate-related health risks. This will require the Philippines to rethink funding and incentivization schemes to ensure financial protection of all Filipinos in relation to health and reinforcing health networks, particularly frontline facilities that serve the most vulnerable populations, to be resilient against the impacts of climate change.
3. **Interoperable information system to monitor and evaluate health vulnerability and capacity developed.** This outcome focuses on empowering health authorities and practitioners at all levels to make data-driven decisions on health adaptation priorities. To enable this, it is critical to expedite efforts in utilizing existing data from different agencies, sectors, and communities and working towards a comprehensive integration of health and climate data.
4. **Resilient, interconnected and community-driven health governance at all levels.** This outcome focuses on establishing effective collaboration mechanisms among various health agencies, sectors and community stakeholders to foster an integrated approach to healthcare planning and DRR-CCA actions. This requires bridging gaps between national policy makers and local health implementors bringing together climate experts and health experts and activating community involvement in maximizing health outcomes.

¹²⁴ Refer to Appendix 3 – Health to see list of policies and programs referenced as part of the NAP process



Priority Adaptation Strategies for Health

Outcome 1: Minimized patient mortality from climate-sensitive diseases through reinforced primary care and community health workers

Implementing Lead agencies:
DOH, DILG (LGUs, Local Government Academy)

Supporting agencies:
CHED, TESDA, DSWD, DOST, DPWH, SUCs

Select Key Strategies	Brief Description	Implementation Priority	Capital Intensiveness
Conduct needs assessment of healthcare workers for climate and disaster risk	Determine training needs and gaps of health care workers and develop tailored adaptation measures, ensuring the continued provision of essential medical services	Immediate (0-3 years)	Medium
Unlock funding for increasing health worker capacity all the way down to barangay level	Initiate policy development to allocate specific funds for adaptation projects, and offering financial incentives or recognition programs to build up health worker capacity and invest in their welfare	Medium-term (3-6 years)	High
Increase coverage of community-based programs for prevention and control of climate-sensitive diseases and risks (e.g., leptospirosis, dengue, pollution)	Scale up community-based programs that focus on education on health risks of indoor and outdoor pollution, vector control measures, early detection, and treatment to effectively prevent and manage climate-sensitive diseases and risks (e.g., promoting use of cleaner cooking stoves, plant-based diets, urban green spaces, etc.)	Medium-term (3-6 years)	Medium
Upskill health workers through the development and incorporation of CCA-DRR modules in the curriculum of all health professionals	Design comprehensive and context-specific training modules that integrate climate change adaptation and disaster risk reduction principles to enhance preparedness and response capabilities of health workers (e.g., impacts to mental health, climate-sensitive diseases, etc.)	Medium-term (3-6 years)	Medium
		Long-term	High



Bridge shortfalls in capacity building at LGUs and local health units to strengthen efficient, affordable, climate-proofed and accessible health care	Establish a capacity-building program for LGUs (especially local chief executives and municipal health officers) on how to re/design local health programs to be climate-proofed/adaptive; prior research needed to design target end-state	(6+ years)	

Outcome 2: Seamless access to climate-responsive health services underpinned by resilient health networks

Implementing Lead agencies: DOH, PhilHealth	Supporting agencies: DILG (LGUs, Local Government Academy), DOTR, DOE, DSWD, DOST, DENR, DPWH, SUCs

Select Key Strategies	Brief Description	Implementation Period	Capital Intensiveness
Conduct climate and disaster risk and vulnerability assessment of healthcare networks and related infrastructure	Conduct data collection and analysis, identify critical assets, assess vulnerabilities, and develop tailored adaptation measures, ensuring the continued provision of essential medical services	Immediate (0-3 years)	High
Establish PhilHealth schemes and provisions to contextualize to climate-change related outcomes	Conduct research and analysis to understand the potential impacts of climate change on public health and identify coverage where PhilHealth schemes and provisions need to be adapted to address climate-related outcomes	Immediate (0-3 years)	Low
Strengthen WASH protocols and prioritize access to health services in post-disaster and makeshift areas	Scale concrete measures to strengthen water, sanitation and hygiene and ensure access to health services, given that diseases can be transmitted easily in post-disaster communities and evacuation centers	Immediate (0-3 years)	Medium
Unlock funding, monitoring and national incentivization schemes	Initiate policy development to allocate specific funds for adaptation projects, and offering financial incentives or recognition	Medium-term (3-6 years)	High



for climate-proofing health facilities, networks and supporting infrastructure	programs to healthcare institutions (public and private)		
Improve and increase equitable access to healthcare, especially in climate-vulnerable, geographically isolated, and disadvantaged areas	Establish strong and responsive primary care, including capabilities on emergency response plans, establishing additional power systems to ensure service delivery, and outreach health programs for underserved communities and bedridden / incapacitated / elderly people who are confined at home	Long-term (6+ years)	High

Outcome 3: Interoperable information system to monitor and evaluate health vulnerability and capacity developed

Implementing Lead agencies:
DOH, DICT, DOST

Supporting agencies:
DILG, PAGASA, DENR, PhiVolcs, NAMRIA

Select Key Strategies	Brief Description	Implementation Period	Capital Intensiveness
Accelerate standardization of data collection especially on climate-sensitive health conditions and diseases	Accelerate progress on DOH's PIDSR ¹²⁵ and FSHIS ¹²⁶ programs to standardized protocols for data collection on climate-related health vulnerability and capacity, ensuring that data from various health facilities and agencies can be integrated into a cohesive information system	Immediate (0-3 years)	Medium
Integration of health information systems with climate data at national and local levels	Integrate health information systems with other information systems such as meteorological / climate / environmental / agricultural / pollution etc., to elucidate climate-health linkages and to inform forecasting, anticipatory planning and decision-making	Immediate (0-3 years)	Medium

¹²⁵ Philippine Integrated Disease Surveillance and Response

¹²⁶ Philippines Field Health Services Information System



Invest in technology and data infrastructure for early warning and anticipatory planning for health	Invest in upgrading technological infrastructure, such as electronic health records and cloud-based systems, to facilitate data sharing and real-time monitoring of health vulnerability and capacity	Medium-term (3-6 years)	High
Build capacity and capability to utilize information systems and make informed decisions that protect population health from climate risks	Conduct training programs for health workers and personnel on how to effectively use information systems for monitoring and evaluating health vulnerability	Long-term (6+ years)	High

Outcome 4: Resilient, interconnected and community-driven health governance at all levels

Implementing Lead agencies:
DOH

Supporting agencies:
DILG, DPWH, DENR, DOST-PCHRD, DSWD, OCD, DICT, NDRRMC

Select Key Strategies	Brief Description	Implementation Period	Capital Intensiveness
Identify trusted climate change champions who can drive health adaptation priorities at national and local levels	Create platforms or networks that bring together potential climate change champions, health professionals, policymakers, and civil society organizations and stakeholder groups to advocate for health adaptation priorities at both national and local levels	Immediate (0-3 years)	Low
Develop and fund a transdisciplinary and people-centered climate and health research agenda	Create and strengthen research centers dedicated to climate and health, deepening transdisciplinary research on impacts of climate change and disasters to health, links and mechanisms of disease causations, and adaptation options and measures; critical to ensure research is properly translated into policy	Immediate (0-3 years)	Medium



Establish formal community-engagement mechanisms to foster knowledge sharing, and collaborative decision-making	Establish community-engagement platforms to ensure that climate-resilience strategies are contextually relevant, effectively implemented, and sustainable over time	Immediate (0-3 years)	Medium
Strengthen health sector and DOH structures to ensure responsiveness to climate risks to health systems	Delineate roles and responsibilities for DRR-CCA issues and establish coordination, communication and collaboration mechanisms	Medium-term (3-6 years)	Medium
Deepen inter-agency and cross-sector collaboration to assess and act on health vulnerabilities	Mainstream DRR-CCA issues into health plans at different levels of the health systems, incorporating health lens into climate plans and actions of other sectors	Medium-term (3-6 years)	High



4.2.4 Ecosystems & Biodiversity

Overview of Ecosystems and Biodiversity in the Philippines

The Philippines is one of the most biodiverse countries in the world, spanning both terrestrial and marine domains - the protection and rehabilitation of its ecosystems is a critical initiative for the Philippines from both an economic and social standpoint, underscored by its inclusion and emphasis in the Philippine Development Plan for 2023-2028.

Economically, ecosystems provide a myriad of direct and indirect economic services, supporting a significant portion of Philippine industries and communities. For example, the Philippines marine reef system is estimated to contribute to >\$1.35B to national economy annually¹²⁷. Smallholder fisherfolk comprise 45% of population living in coastal areas, are dependent on reefs for their livelihood. Mangroves in Tawi-Tawi were estimated to provide from 3,216 to 4,733 USD/hectare annually¹²⁸, while the Philippine reef ecosystem services were estimated to amount to USD 4 billion, or 140k USD/km² annually¹²⁹. Ecosystems also provide value in the form of protection against climate hazards – for example, as of 2018, Philippine mangroves were found to prevent flooding damages of over 1.7B USD per year¹³⁰.

This value applies socially as well, as ecosystems provide valuable protection to neighboring communities – the same Philippine mangroves were found to prevent flooding exposure towards over 500,000 Filipinos per year, with 23% of this group residing beneath the poverty threshold. The combined social and economic ecosystem services provided to Filipinos are undeniably invaluable, but have yet to be fully accounted for.

Finally, in terms of biodiversity, with 7,641 islands and its geographic location at the apex of the Coral Triangle, the Philippines stands as one of the 18 mega-biodiverse countries in the world and is ranked third in terms of marine biodiversity across its many coral reef, mangrove, seagrass, and wetland

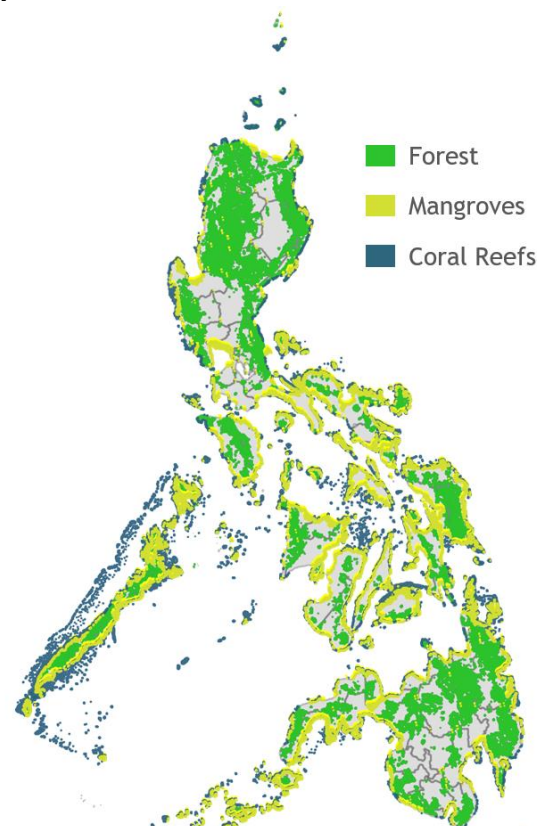


Figure 4.2.4.1 Overview of Philippine Forests, Mangroves, and Coral Reefs

¹²⁷ Department of Environment and Natural Resources – Biodiversity Management Bureau. (2016). Philippine Biodiversity Strategy and Action Plan 2015-2018

¹²⁸ Roldan, R.B. (2022). ECONOMIC VALUATION OF MANGROVES IN TAWI-TAWI ISLANDS, SOUTHERN PHILIPPINES: A MARKET PRICE AND CONTINGENT VALUATION APPROACH

¹²⁹ Tamayo, N., Anticamara, J., Acosta-Michlik, L. (2018). National Estimates of Values of Philippine Reefs' Ecosystem Services.

¹³⁰ Beck, M.W. et. Al. (2018). Valuing the protection services of mangroves at national scale: The Philippines



ecosystems, while also housing a wide range of terrestrial ecosystems, from grasslands to forests. The country's terrestrial and marine ecosystems also contain some of the richest biodiversity of flora and fauna composed of more than 25,000 endemic species¹³¹.

Poor management and exploitation plague Philippine ecosystems. Over the past decades, Philippine ecosystems have undergone rapid degradations due to large-scale deforestation and grassland conversion, urbanization, mining, and dam construction leading to freshwater alteration, river and lake pollution from domestic and industrial sources, as well as the general decline of mangrove and coral reef habitats. Extensive logging has decimated 75% of the Philippines' forests, and while numerous land zoning and ecosystem protection policies are being implemented today, the decline in forests continues at a rate of 1.9% annually, leaving just 6 to 8% of primary forest cover. Forested and logged areas are converted to agriculture, overfishing depletes fishery resources, and destructive practices like poisoning and dynamiting severely damage the valuable coral reefs, with only 5% of Philippine coral reefs retaining 75 to 100% live coral cover presently. This widespread environmental deterioration has impacted numerous endemic species as highlighted by the IUCN, which reports that 21% of the country's vertebrates and over half of its known plant species are already under threat.

Climate Change Impacts on Ecosystems and Biodiversity

Ecosystems across the world are particularly vulnerable to climate change, and the Philippines is no exception. Degradation of ecosystems caused by humans is expected to be compounded by climate change – for example, coral bleaching from El Niño in 1997-98 decreased live coral cover in the Philippines by up to 49% - reefs in El Nido were particularly hard hit, going from 60-70% coral cover to 5-10%, according to the National Climate Change Action Plan. A three-year massive global coral bleaching event was likewise documented from 2014-2017, the longest ever recorded, which occurred alongside successive record-breaking hot years¹³².

Impacts like these have cascading effects on the same communities and biodiversity that these ecosystems protect – for example, researchers from Charles Darwin University in Australia and the National University of Singapore found that a 10% increase in deforestation results in a 4-28% increase in flood frequency¹³³. In terms of biodiversity, the Philippines ranks among the top ten countries with the largest number of species threatened with extinction. Certain species are very sensitive to climate change related impacts and the corresponding habitat loss caused by increased temperature, erratic rainfall distribution, and more intense typhoons which significantly reduce their respective populations.

Worsening climate trends will have severe impacts Philippine ecosystems, biodiversity, and overall ecological stability if not addressed promptly. While varied depending on the ecosystem in question, the intensification of severe weather events could lead to the deterioration of habitats and

¹³¹ Ani, P., Castillo, M. (2020). Revisiting the State of Philippine Biodiversity and the Legislation on Access and Benefit Sharing

¹³² Eakin, C.M., Sweatman, HPA, Brainard, R E. (2019). The 2014–2017 global-scale coral bleaching event: insights and impacts. Coral Reefs.

¹³³ BRADSHAW, C.J., SODHI, N., PEH, K. and BROOK, B. (2007). Global evidence that deforestation amplifies flood risk and severity in the developing world. *Global Change Biology* (2007) 13, 1—17



disruption of ecological balance, further endangering various species. Chronic events such as rising temperatures and sea levels are also anticipated to contribute to habitat degradation, compromised species health, and a decline in biodiversity. The table below outlines the adverse effects of different climate drivers on these vital ecosystems and the rich tapestry of life they support.

Table 4.2.4.1. Impacts of climate hazards on Ecosystems & Biodiversity

Climatic driver	impact-	Impacts to Ecosystems & Biodiversity
Increased temperature and Drought	and	Water scarcity for flora and fauna Increased temperature and drought may reduce water availability, leading to the reduction of species population who depend on specific aquatic habitats, the redistribution of others, or the stunting of growth of terrestrial and mangrove forest trees and potentially forest die-offs, while also increasing the risk of forest fires and raising probability of saltwater intrusion Coral bleaching Raised sea temperatures can lead to coral bleaching and the resulting degradation of reef ecosystems
Sea level rise and extreme sea levels		Coastal and marine habitat submersion Mangrove forests risk submersion, leading to the loss of their protective functions and crucial habitats for fish and other wildlife. Increased saltwater intrusion also affects mangrove growth and survival. Higher sea levels may also lead to limited access for corals to photosynthesize, stunting their growth or even leading to mortality Saltwater intrusion Sea levels result in increased saltwater intrusion into river systems, affecting freshwater availability, water quality, and the distribution of freshwater species. It disrupts the natural flow regimes of rivers. Storm surges and coastal flooding associated with extreme sea levels inundate lowland forests, leading to soil erosion, loss of biodiversity, and changes in species composition. In wetland and marsh areas, this changes vegetation composition and potential loss of habitat for wetland-dependent species.
Extreme precipitation		Flooding leading to forest damage Intense rainfall increases the risk of flooding and weakens earth composition in forested areas, triggering landslides leading to soil erosion, habitat destruction, and changes in vegetation structure. Tree Mortality and Species Composition



	Prolonged and excessive rainfall saturates the soil, leading to waterlogging and reduced oxygen availability for tree roots. This results in tree mortality and alterations in species composition. Intense rainfall events also cause temporary inundation and changes in water chemistry within wetland and marsh areas, influencing vegetation composition and affecting wetland-dependent species. Salinity fluctuations Intense rainfall can lead to freshwater influx into estuaries, altering salinity levels and affecting mangrove forests. Changes in water chemistry can impact mangrove species composition and disrupt nursery habitats for marine species.
Wind patterns and tropical cyclones	Structural damage Strong winds during cyclones uproot trees and cause widespread damage in forested areas, leading to habitat destruction, altered forest structure, and loss of biodiversity. Intense winds also result in riverbank erosion, increased sedimentation, and altered flow dynamics, affecting the structure and function of riverine ecosystems. Likewise, this damages wetland and marsh ecosystems, leading to changes in vegetation composition, habitat loss, and potential impacts on marine and wetland-dependent species.

Distinct ecosystems are each particularly vulnerable towards a specific climatic impact-driver - sea level rise inundating mangroves, increased air temperatures bleaching coral reefs, and extreme precipitation causing inland flooding forested areas¹³⁴.

Sea level rise has been known to cause stress to mangrove trees, driving the retreat or disappearance of mangrove forests in submerged areas. By the 2030 decade, 32% of mangroves in the nation are projected to be exposed to sea level rise flooding of 1 meter, further increasing to 48% in the decade between 2050 and 2060 – 70% of this impact may materialize along the coasts of regions IV-A, IV-B, V, VIII, and XIII. In particular, the mangroves of the provinces of Palawan and Quezon are expected to face the most exposure, each at approximately 90km². This impact on mangrove forests combined with the expected vulnerability of regions IV-A, V, and VIII highlighted in Chapter 3.3 due to more frequent and intensified extreme sea levels may lead to compounded impacts that local government units should be prepared for.

¹³⁴ Quantitative climate impacts outlined in this chapter are projected based on climate models developed as part of the National Adaptation Plan process. Detailed methodology for climate models per sector can be viewed on Appendix 2 and Appendix 3 – Ecosystems and Biodiversity

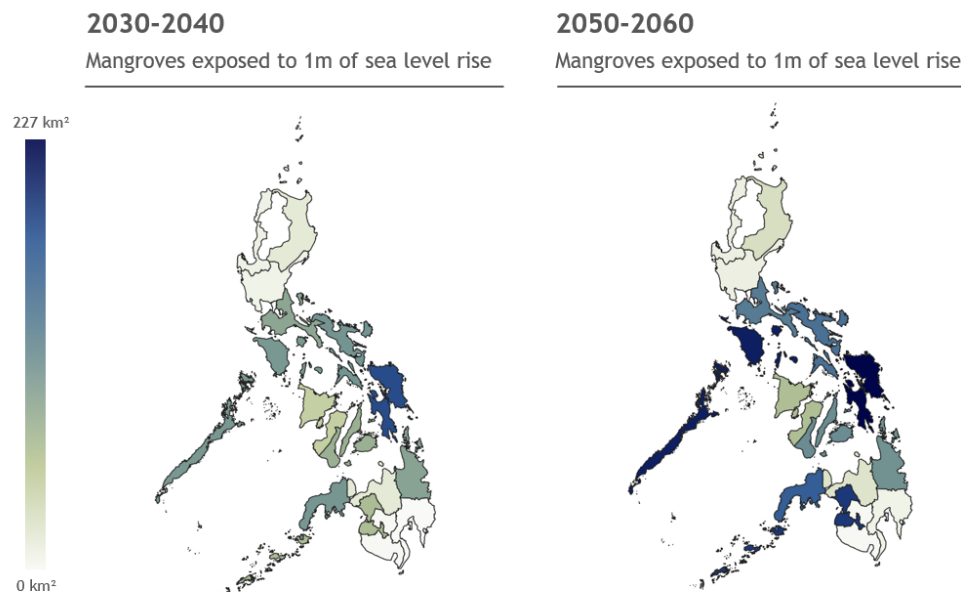


Figure 4.2.4.2 Mangroves exposed to 1m of sea level rise between 2030-40, 2050-60, SSP5-8.5

Rising temperatures are by far the most threatening climatic impact-driver for coral reefs – from 2030-2040, 19% of coral reefs across the Philippines may be exposed to a rise in air temperature of 1 degree Celsius or more. Of this exposure, close to half of the exposed coral reefs are projected to fall within Region IV-B and Palawan in particular, despite it making up only a fifth of the total reef area of the Philippines. Of note, the coral reefs of Palawan house the Tubbataha Reef, a UNESCO-declared World Heritage Site where-in 75% of the world's known corals and can be found.

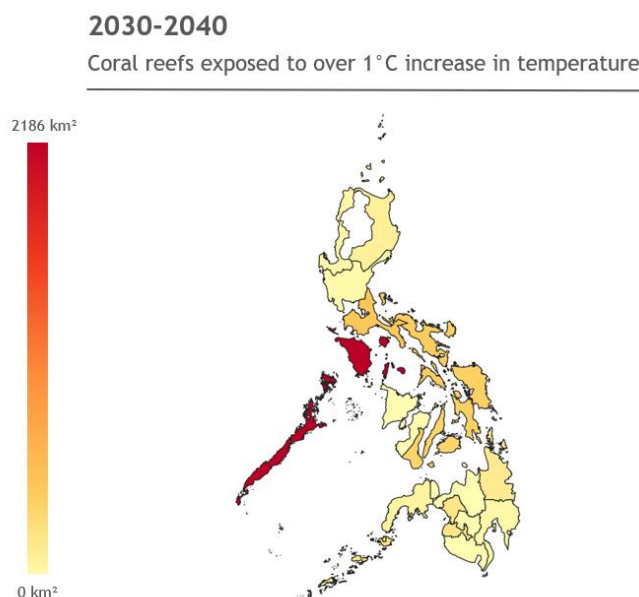


Figure 4.2.4.3 Coral reefs exposed to over 1-degree Celsius increase in air temperature between 2030-40, SSP5-8.5



While they protect communities from the impacts of flooding, forests themselves are vulnerable to the impacts caused by extreme precipitation. Between 2030-2040, over a third of Philippine forests are projected to be exposed to either pluvial or fluvial floods exceeding 1 meter in depth, further increasing to ~47% in the decade of 2050. Over 65% of this exposure is expected to be observed in CAR and Regions II, III, IV-B, and XI, with CAR in particular composing more than a fifth of the exposed forests. In terms of provinces, Palawan, Abra, and Benguet are expected to see the most forest exposed to such floods. Given forests' importance in minimizing damage caused by floods and landslides in nearby communities, it is important to highlight further vulnerability of CAR, Region II, III, IV-B, XI, regions already identified as among the most at risk due to pluvial and fluvial flooding, and Benguet being the most susceptible province towards landslides in Chapter 3.3 when selecting and localizing strategies to be implemented.

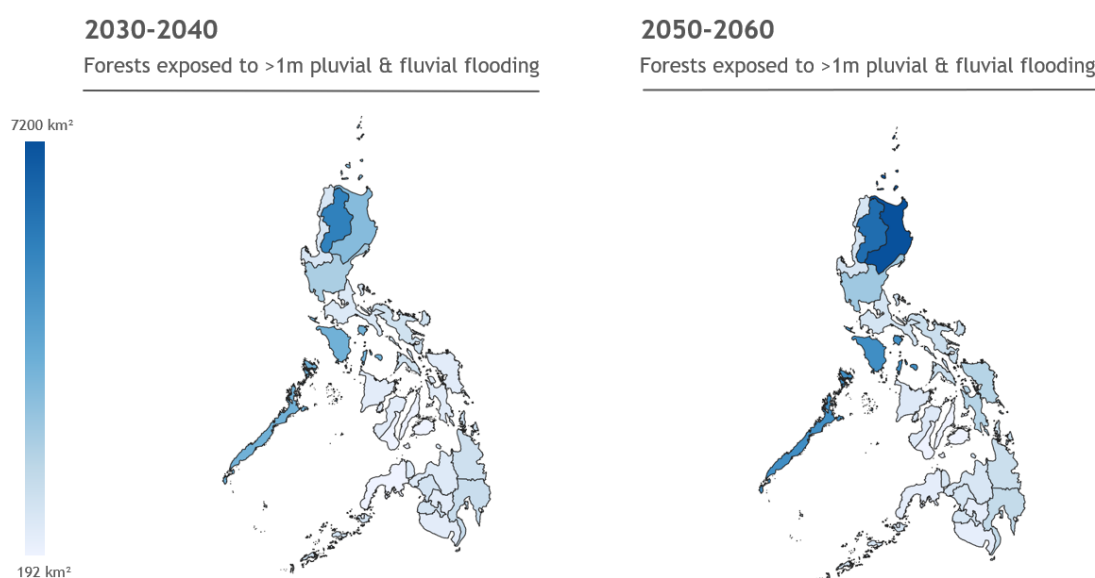


Figure 4.2.4.4 Forests exposed to 1m of pluvial or fluvial flooding between 2030-40, 2050-60, SSP5-8.5

Priority Adaptation Outcomes for Ecosystems & Biodiversity

Grounded on national policies and existing programs related to this sector¹³⁵, the adaptation theme for Ecosystems & Biodiversity is **Safeguard Biodiversity: Restore Natural Assets**.

Three priority outcomes underpin this strategy:

- 1. Ecosystems accounts developed and regularly updated to monitor and enhance regulating services for adaptation.** This outcome focuses on the valuation of ecosystem services and developing and maintaining ecosystems accounts to optimize understanding of the regulatory services of ecosystems and inform policy development and investment plans for adaptation. To

¹³⁵ Refer to Appendix 3 – Ecosystems & Biodiversity to see list of policies and programs referenced as part of the NAP process



achieve this, accounting and monitoring programs that have been rolled out must be strictly and regularly enforced by local government units.

2. **Protected and rehabilitated biodiversity across habitats and ecosystems.** This outcome focuses on the protection and rehabilitation critical habitats and ecosystems, maintaining their interconnectedness for biodiversity and ecosystem service output amidst climate hazards, following well-received approaches such as the Ridge-to-Reef Approach, while capitalizing upon Ecosystem-based Adaptation (EbA) or Nature-based Solutions. To achieve this outcome, efforts must go beyond protection of remaining ecosystems to active rehabilitation and restoration, as well as the protection of areas surrounding key ecosystems. Academe and the public are key actors in supporting the programs that work towards this outcome.
3. **Enabled and empowered communities to lead ecological management.** This outcome focuses on equipping and supporting local communities to enable their active involvement in the planning, decision-making, and implementation of management and conservation of ecosystems. To achieve this, involvement and capacitation of local communities and government units, indigenous people, and the private sector is critical.

Prioritizing adaptation strategies that ensure resilient and well-monitored ecosystems will not only bolster the nation's capability to withstand climate change, but also provide a long-lasting source of value derived from ecosystem services for generations to come. Strategies must involve comprehensive, and regular accounting and monitoring programs to guide decision making regarding ecosystems combined with well-enforced protection, management, and rehabilitation programs to ensure decisions are implemented as intended.

Priority Adaptation Strategies for Ecosystems & Biodiversity

Outcome 1: Ecosystems accounts developed and regularly updated to monitor and enhance regulating services for adaptation	
Implementing Lead agencies: DENR	Supporting agencies: DOST, NEDA, PSA

Select Strategies	Key	Brief Description	Implementation Priority	Capital-intensiveness
Expand and improve upon ecosystem zoning and mapping		Spatial planning that designates areas for different uses and conservation priorities/actions such as DENR's Natural Resources Assessment, while updating documents such as DHSUD's Zoning Guidebook/Development Controls	Immediate (0-3 years)	High



Implement vulnerability assessment and monitoring programs	Detection of climate change indicators in certain ecosystems enabling enactment of other interventions	Immediate (0-3 years)	Medium
Implement existing programs to perform natural capital accounting and valuation of ecosystem services	Quantifying and valuing natural capital and ecosystem services to assess their economic value through a standardized approach, informing decision-making and management to ensure resiliency of ecosystems to climate change, building upon the Roadmap to Institutionalize Natural Capital Accounting in the Philippines	Long-term (6+ years)	High
Perform long-term ecosystem research to enhance assessment of consequences of management and policy decisions	Long-term (6+ years) research on and monitoring of changes in ecosystems due to changes in land use, climate change, and other environmental factors	Long-term (6+ years)	High

Outcome 2: Protected and rehabilitated biodiversity across habitats and ecosystems

Implementing Lead agencies: DENR	Supporting agencies: DILG, DAR, DA, SUCs, DepEd, CHED

Select Key Strategies	Brief Description	Implementation Priority	Capital-intensiveness
Identify, assess, and monitor vulnerable habitats on a regular basis	Identification of high priority habitats, followed by assessment to enable timely protection from further degrading natural and anthropomorphic activities combined with proactive rehabilitation to minimize further loss amidst climate change	Immediate (0-3 years)	Medium
Enhance implementation of existing laws, regulations and guidelines	Ensuring protection and interconnectivity of ecosystems to maximize their resiliency to climate change following principles such as the Ridge-to-Reef approach, while regulation of activities permitted (e.g., no trawling, farming, etc.) within prioritized ecosystems, with policies such as RA 7586 or	Medium-term (3-6 years)	Medium



	National Integrated Protected Area System Act (NIPAS) and RA 11038 or Expanded National Integrated Protected Area System (ENIPAS) Act		
Rehabilitate and restore coastal and marine ecosystems	Managed realignment of coastlines; re-establishing and protecting coastal habitats including mangroves, saltmarshes, coral reefs, sea grass beds, and other such ecosystems with high adaptation potential	Medium-term (3-6 years)	High
Establish coastal setback zones/boundaries	Survey/mapping and delineation of tidal datum lines to build resiliency of coastal ecosystems through the Wetland Conservation Program, and Coastal and Marine Ecosystems Management Program (CMEMP)	Medium-term (3-6 years)	High
Restore degraded forests and deforested areas	Facilitate forest restoration to ensure their resiliency amidst climate change through the DENR's NGP using diverse strategies including, reforestation, agroforestation, ANR, and tree plantation development	Long-term (6+ years)	High
Strengthen the monitoring and management of threatened and rare species	Monitoring and identification of most suitable measures to take (managed relocation, captive breeding, supplementation, etc.) to avoid further loss amidst climate change, building upon the Threatened Species Conservation and Management Program, and the Protection and Conservation of Wildlife Program	Long-term (6+ years)	Medium

Outcome 3: Enabled and empowered communities to lead ecological management

Implementing Lead agencies: DENR	Supporting agencies: DILG, DAR, DA, SUCs, NCIP

Select Key Strategies	Brief Description	Implementation Priority	Capital-intensiveness



Run public education/ awareness programs on the importance of ecosystems	Publicizing the role of ecosystems in supporting human society, reducing anthropogenic pressures for development and minimizing further loss amidst climate change	Immediate (0-3 years)	Medium
Establish collaborative research partnerships	Partnerships between local communities, researchers, and environmental organizations to provide access to scientific expertise, enabling ecological assessments, and better-informed decisions at a local level to improve resiliency of ecosystems	Immediate (0-3 years)	High
Enact legislation to support community-based ecological management	Policies and programs established at an LGU level, integrated with supporting programs such as Payment for Ecosystem Service (PES) programs, ecotourism development and Biodiversity-friendly enterprises (BDFE) to legitimize local communities' ownership and encourage sustainable use across ecosystems	Immediate (0-3 years)	Medium
Enact legislation to enhance uses of land, ecosystems and watersheds	Enacting National Land Use Act and Sustainable Forest Management Act that will facilitate the integrated and coordinated uses of land, ecosystems and watersheds for socioeconomic purposes and environmental protection to help ensure resiliency across ecosystems and the communities that depend on them	Immediate (0-3 years)	Low
Establish Payment for Ecosystem Services (PES) programs	Financial incentives to landowners and communities for implementing practices that enhance ecosystem services, such as reforestation, wetland restoration, or sustainable land management – integrate PES into nature-dependent industries such as tourism	Medium-term (3-6 years)	High
Implement eco-certification programs	Certifications and labels for businesses that meet certain criteria, such as sustainable resource use, habitat protection, or pollution reduction, helping	Medium-term (3-6 years)	Medium



	encourage the improvement of ecosystem resilience		



4.2.5 Cultural Heritage, Population Displacement and Migration

Overview of Cultural Heritage, Population Displacement and Migration in the Philippines

Addressing climate-induced human mobility with a lens of cultural heritage preservation is critical in planning for adaptation measures for the Philippines. As a result of climate-related environmental stressors, many Filipino communities now face challenges on human mobility. Increasingly, mobility is seen as an adaptation strategy to manage impacts of climate change.

From an economic perspective, effective integration of displaced individuals and migrants into the local workforce can lead to improved human capital in relocated areas. In addition, proper measures to address integration into localities can utilize the skills and talents of migrants, leading to increased economic productivity and growth.

More importantly, from a social standpoint, proper reintegration of populations ensures that communities can maintain their unique traditions, languages, and ways of life. With the Philippines' rich and diverse identity, fostering a sense of belonging, social cohesion, and continuity across generations is a critical element of climate adaptation. The country has a responsibility to ensure the dignity and well-being of individuals and communities who have left their homes due to climate-related events. Upholding human rights and providing aid reflects the Philippines' values and commitment to basic principles of fairness and justice, especially since it is society's most vulnerable populations that are most impacted by these events.

Today, discussions on climate emergencies in relation to communities focus on recovery from rapid onset events like typhoons, storm surges, and floods. However, there is a need to consider the whole spectrum of human mobility considering climate change: migrants, returning migrants, temporary evacuation, permanent evacuation, and voluntary and involuntary mobility. Proper reintegration of displaced populations and support for populations needing to migrate due to slow onset events (e.g., chronic physical impacts of climate change) need to be central to climate adaptation priorities. Individuals lose their livelihoods and income sources when they move, and reintegrating them into the workforce can be challenging, especially if their skills do not match local job market demands. Reintegration efforts may face difficulties in ensuring that populations have access to essential services, especially since overcrowding in host communities can strain existing infrastructure and resources. Lastly, cultural differences and misconceptions often lead to exclusion and marginalization. The Philippines needs to strengthen its proactive planning approach to human mobility and shift away from reactive disaster management and response. There is an opportunity to enhance capacities and design durable solutions to address migration, displacement and planned relocation.

Climate Change Impacts on Cultural Heritage, Population Displacement and Migration

Two key considerations are center to the discussions on climate change impacts on human mobility in the Philippines. First, the increasing frequency and magnitude of climatic impact-drivers will continue to affect migration patterns in the country. Over 15 million Filipinos were estimated to be



voluntarily and involuntarily displaced by 245 reported climate disaster events from 2020 to 2022.¹³⁶ Displaced populations, including those who have migrated due to slow onset environmental pressures, face the dual challenge of finding new settlements, while contending with unfamiliar surroundings and limited resources. The disruption caused by climate change exacerbates the vulnerability of these populations, compounding their struggle for adequate housing, livelihoods and access to essential services.

Second, the Philippines also houses large groups of indigenous communities across the archipelago: an estimated 14-17 million indigenous people (IP) belong to 110 different ethnolinguistic groups¹³⁷. These indigenous groups inhabit remote or ecologically sensitive land that are increasingly susceptible to adverse climate events, further exacerbated by environmentally destructive projects.¹³⁸ Displacement from their cultural lands impacts their way of life significantly, as land is integral to their cultural identity, livelihoods, spiritual practices, social structures, and traditional knowledge systems. In addition, these communities are more economically vulnerable, with 73% of all IPs belonging to 40% poorest of the population¹³⁹.

Adapting to the impacts of climate change is a complex endeavor, especially when it comes to the unique needs of indigenous communities. In essence, successful adaptation strategies for indigenous communities necessitate a holistic approach that embraces their cultural heritage, safeguards their land rights, taps into traditional knowledge, respects cultural nuances, and empowers them to shape their own future in the face of climate change.

To enact this, adaptation efforts should respect and integrate indigenous traditions, languages, and knowledge systems. Many indigenous groups have deep cultural and spiritual connections to their ancestral lands. As such, ensuring their ownership and control over these lands is not only a matter of justice but also a strategy for sustainable adaptation.

Indigenous communities also possess invaluable traditional ecological knowledge about resource management that has been developed over generations. This wisdom, which often involves sustainable practices and harmonious coexistence with the environment, should be acknowledged and incorporated into adaptation plans.

Lastly, engaging indigenous leaders and community members in decision-making processes is crucial to ensuring adaptation measures are effective and well-received. They should be provided with the resources, training, and support needed to take an active role in designing and implementing their own adaptation strategies.

¹³⁶ Internal Displacement Monitoring Centre. (2022). Country Profile: Philippines - Displacement Data [Dataset]. In Disaster Data. <https://www.internal-displacement.org/countries/philippines>

¹³⁷ Legal Rights and Natural Resources Center. (2022). State of Indigenous Peoples Address 2022 Report. Legal Rights and Natural Resources Center - Friends of the Earth Philippines. Retrieved August 14, 2023, from <https://www.lrcksk.org/post/sipa-2022-report-launched-half-of-ancestral-domains-found-under-environmental-threat>

¹³⁸ Previous studies have found that almost half of all Certificate of Ancestral Domain Titles (CADTs) are embroiled in environmentally destructive projects

¹³⁹ International Organization for Migration - Philippines. (2021). Framing the Human Narrative of Migration in the Context of Climate Change. In International Organization for Migration



Climate change poses large threats to the well-being of migrants and indigenous peoples. The negative impacts of climate change largely exacerbate current risk conditions for displaced populations, particularly for existing vulnerable populations. The table below highlights some of these negative effects.

Table 4.2.5.1. Impacts of climatic impact-drivers on Cultural Heritage, Population Displacement and Migration

Climatic impact-drivers	Impact to Cultural Heritage, Population Displacement and Migration
Sea level rise and extreme sea levels	Expected increase of climate refugees Slow onset climate events (e.g., rising sea levels) will persistently drive populations away from their settlements, amplifying the need for managed retreat and mobility as an adaptation strategy.
Extreme precipitation	
Wind patterns and tropical cyclones	
Increased temperatures and droughts	Increased mobility due to extreme heat Increased temperature can affect the productivity of agricultural land. These circumstances may result in farmers seeking other sources of livelihood in other areas. Disruption of livelihoods Loss of stable livelihoods, overcrowded settlements with limited infrastructure and resources can trap displaced populations in a cycle of vulnerability. Loss of educational continuity for children Children who are displaced due to climate change may end up in areas with limited access to quality education facilities and resources. Loss of access to services Displaced populations often have difficulty in accessing necessities, such as shelter, infrastructure, and social services, exacerbating their vulnerabilities and hindering recovery and resettlement efforts. Potential loss of culture and traditions Climate-induced displacement can sever ties between populations and their cultural heritage rooted in specific geographic locations including traditional practices, language, rituals and ways of life. Increased conflict and instability¹⁴⁰ Climate-related impacts can exacerbate existing social and political tensions and contribute to instability in vulnerable regions (e.g. BARMM), often through indirect pathways. Populations displaced by a combination of both conflict and the consequences of climate change are extremely unlikely to be able to return home.

¹⁴⁰ United Nations Framework Convention on Climate Change (UNFCCC). (2022). Conflict and Climate. UNFCCC. Retrieved September 14, 2023, from <https://unfccc.int/blog/conflict-and-climate>



	Links with trafficking in persons and smuggling of migrants¹⁴¹ While climate risks do not in themselves cause trafficking in persons and smuggling of migrants, these can create personal, situational and contextual that place migrants unfavorable conditions, especially women.

Among the various climatic impact-drivers, wind patterns and tropical cyclones and pluvial flooding¹⁴² are projected to affect the largest magnitude of populations¹⁴³. In the 2030 decade, an estimated 5.3 million people per year will be exposed to at least one Category 4 or Category 5 cyclone, of which 20% are impoverished populations who have limited resources to resist, adapt or recover from voluntary or involuntary migration. In the 2050 decade, an estimated 6 million people per year will be exposed to cyclones, most affected of which include Region V, CAR and Region II, in terms of percent of population exposed in the region. In terms of absolute number of populations exposed, highly populated regions including NCR, Region IV-A and Region III are most impacted in both 2030 decade and 2050 decade.

On the other hand, 4.8 million Filipinos per year are projected to be exposed to pluvial floods. CAR, Region IV-A, Region V and Region X have ratios of populations most exposed to pluvial floods relative to its regional population. It is worth noting that the largest indigenous groups are mainly concentrated in CAR (33% of IPs). While exposure to climate events does not directly lead to climate-induced migration, recurring exposure to these climate risks increases the occurrence of potential migration.

¹⁴¹ United Nations Office on Drugs and Crime (UNODC). (2022). Policy Brief Climate, Crime and Exploitation: The gendered links between climate risk, trafficking in persons and smuggling of migrations. Retrieved September 14, 2023, from https://www.unodc.org/documents/human-trafficking/GLO-ACTII/UNODC_Climate-TIP-SOM_Policy_Paper.pdf

¹⁴² Pluvial, fluvial and extreme sea level-driven floods are modelled on a 10-year return period, represented by flood heights with a 10% chance of occurring in a year

¹⁴³ Quantitative climate impacts outlined in this chapter are projected based on climate models developed as part of the National Adaptation Plan process. Detailed methodology for climate models per sector can be viewed on Appendix 2 and Appendix 3 – Cultural Heritage, Population Displacement and Migration

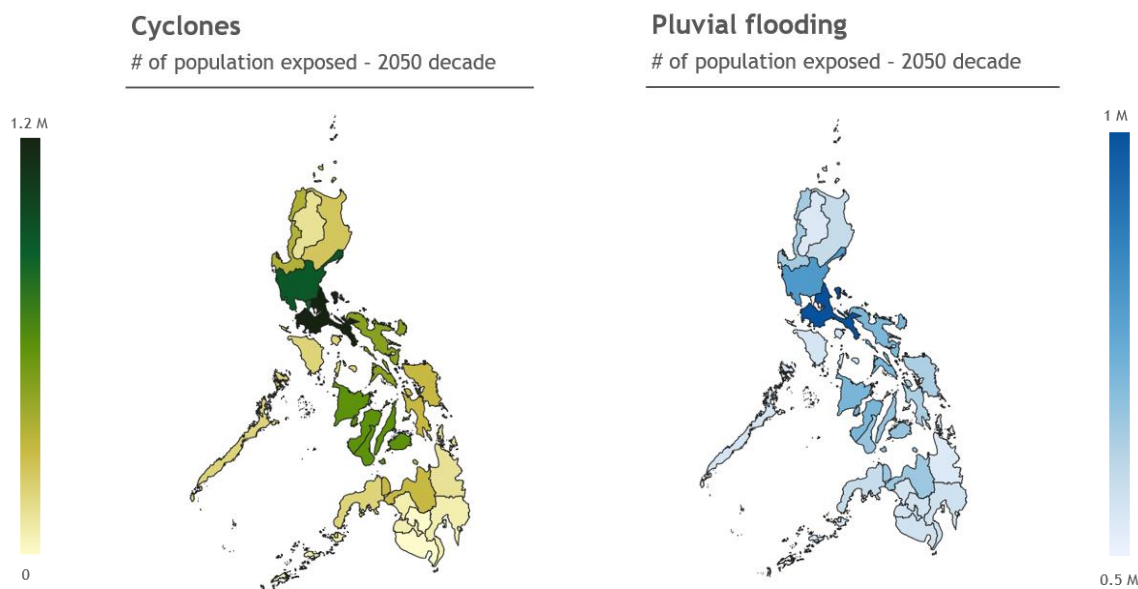


Figure 4.2.5.1. % populations exposed to cyclones in 2050 decade and % of populations exposed to pluvial flooding in 2050 decade

Migration due to slow onset climate events such as sea level rise is also a key climate risk that will impact this sector. In the 2030 decade, an estimated 150,000 Filipinos per year may be exposed to sea level rise. In the 2050 decade, this increases to an estimated 425 thousand Filipinos per year, of which 50% of populations exposed are from Region III and Region V. Over 150,000 elderly and children are also projected to be exposed to sea level rise, accounting for populations who will have limited ability and/or resources to fend for themselves.

As these populations are exposed to sea level rise and its permanent effects, this may necessitate voluntary or involuntary migration away from their areas of settlement. Various mobility strategies will need to be employed to manage human mobility in light of climate change, considering populations' desire to migrate as well as their capability to do so.

Notably, among vulnerable population segments, Filipinos below the poverty threshold are projected to be disproportionately exposed to sea level rise, particularly provinces in Southern Mindanao. Impoverished populations often have fewer social networks and connections that can influence their capability to migrate. This results in either involuntary immobility, where populations may then continue to be exposed to harmful hazards, or forced mobility, where reintegration efforts may be constrained by their limited financial resources. Inclusive policies, social safety nets, education and skill development programs, and community engagement initiatives are crucial to ensure successful reintegration and reducing the disparities faced by the poor.

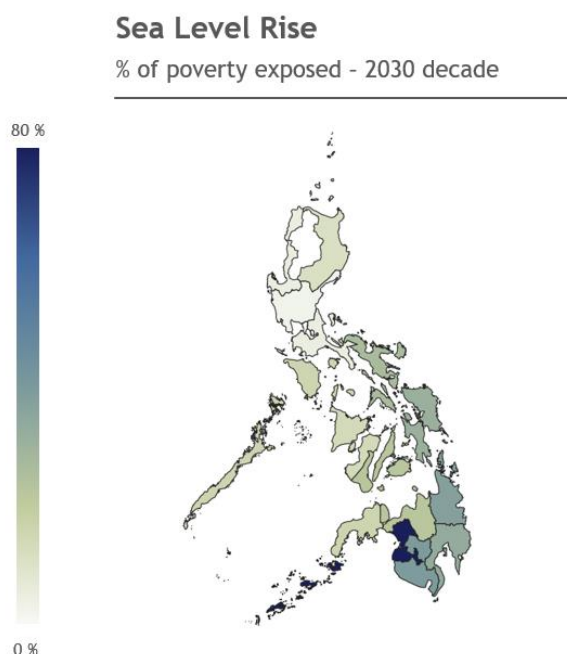


Figure 4.2.5.2. % impoverished exposed among exposed populations in 2030 decade

Priority Adaptation Outcomes for Cultural Heritage, Population Displacement and Migration

With expectations of increased instances of climate-induced human mobility¹⁴⁴, the adaptation theme for Cultural Heritage, Population Displacement and Migration is **Safeguarding Communities & Culture: Durable Solutions for Climate-Induced Mobility**.

Three priority outcomes underpin this strategy:

1. **Provision of adaptive physical, social and economic support to populations displaced by sudden climate events.** This outcome focuses on ensuring displaced populations, regardless voluntary or involuntary, have access to mechanisms that protect their physical, social and economic welfare. This includes access to temporary shelter and/or safe sustainable permanent housing options, access to basic services, and access to temporary/long-term employment opportunities. Displaced populations must deem relocation areas conducive for living.
2. **Robust preparatory and reintegration support for populations impacted by slow onset climate events.** This outcome focuses on providing psychosocial and sufficient preparatory aid to communities affected by gradual onset climate events. Ensuring the mental well-being and readiness to cope with long-term environmental changes is critical, especially for populations who migrate involuntarily from their areas of settlement. Focus needs to be given to vulnerable segments such as children, women, persons with disabilities, and the elderly to ensure support for reintegration into new communities.

¹⁴⁴ Refer to Appendix 3 – Cultural Heritage, Population Displacement and Migration to see list of policies and programs referenced as part of the NAP process



- 3. Preservation, protection and rehabilitation of cultural heritage amidst climate risks.** This outcome focuses on deploying proactive measures to preserve and protect cultural heritage to safeguard important aspects of Filipino history and identity. This includes the protection of not only physical cultural heritage sites, but also takes into consideration unique circumstances of indigenous peoples and their ties to ancestral land.

Priority Adaptation Strategies for Cultural Heritage, Population Displacement and Migration

Outcome 1: Provision of adaptive physical, social and economic support to populations displaced by sudden climate events

Implementing Lead agencies:
NDRMMC, DSWD, DHSUD, DENR

Supporting agencies:

OCD, DILG, NHA, Commission on Population & Development, PCW, Philippines' National Council on Disability Affairs, National Commission of Senior Citizens

Select Key Strategies	Brief Description	Implementation Priority	Capital Intensiveness
Provide adequate social facilities and programs in resettlement areas	Organized community events and programs aimed towards inclusion and acceptance of displaced individuals within their new communities, as well as creation of social facilities in resettlement areas (e.g., day care centers, recreational spaces, etc.)	Immediate (0-3 years)	High
Strengthen recovery coordination between public sector, community volunteers, CSOs/NGOs and the private sector	Strengthen NDRRMC and other multi-stakeholder task forces that facilitate regular communication, information sharing, and joint planning among the public sector, CSOs/NGOs, and the private sector to identify resource gaps and streamline recovery strategies	Immediate (0-3 years)	Medium
Develop incentive mechanisms to encourage climate-resilient shelter design and construction	Upgrade new and available shelters using locally available, sustainable materials and techniques, elevated in flood-prone areas, integrated with renewable energy sources and rainwater harvesting systems	Immediate (0-3 years)	High
	Widen distribution and reach of food stamps, rations, emergency food	Immediate (0-3 years)	High



Provide temporary subsidies for necessity support	distribution, education, and healthcare subsidies		
Capacitate regional offices to roll out Post-Disaster Shelter Recovery Policy Framework to LGUs	Implement action plans along dimensions of the policy framework, including institutional arrangements, shelter recovery practices, shelter recovery planning, shelter recovery financing, and shelter recovery implementation, with direct focus on most vulnerable segments: women, elderly, youth, and persons with disabilities	Immediate (0-3 years)	High
Introduce variety of local sources of livelihood available in the locality	Coordinate with nearby communities to identify open economic opportunities for resettled communities to tap into	Medium-term (3-6 years)	High
Build resilient social enterprises through public-private partnerships	Create programs that will enable displaced communities to set up or contribute social enterprises (e.g., green solutions/products) through public-private partnerships	Medium-term (3-6 years)	Medium
Broaden access to local financing and lending facilities	Ensure displaced communities have access to financing and lending facilities to support their relocation	Medium-term (3-6 years)	Medium
Scale partnerships with NGOs and train up local healthcare providers, licensed social workers and emergency responders	Joint programs to deliver services and programs to address the psychological and social needs of individuals and communities who have been forcibly displaced or relocated	Medium-term (3-6 years)	High

Outcome 2: Robust preparatory and reintegration support for populations impacted by slow onset climate events

Implementing Lead agencies: NDRMMC, DSWD, DHSUD, DOLE	Supporting agencies: OCD, DILG, NHA, Commission on Population & Development, DENR

Select Key Strategies	Brief Description	Implementation Priority	Capital Intensiveness
Define national policy framework on climate-induced migration to	Determine national policy and framework to assess, support and reintegrate climate refugees and	Immediate (0-3 years)	High



ensure social protection	other migrants affected by climate change, with a focus on activating social preparation methods for return or resettlement into new areas		
Scale targeted community education programs to increase awareness on climate risks	Establish comprehensive early warning systems to monitor and predict slow onset climate events and combine with targeted community education programs to increase awareness about the potential impacts	Immediate (0-3 years)	Medium
Strengthen capacities on safe evacuation and disaster response	Enhance skills and readiness of individuals and communities to effectively carry out safe evacuation procedures and respond to disasters	Immediate (0-3 years)	Medium
Facilitate mechanisms for community-based adaptation planning	Facilitate participatory adaptation planning at the community level by collaborating with locals to identify specific vulnerabilities and design context-specific strategies	Medium-term (3-6 years)	Medium

Outcome 3: Preservation, protection and rehabilitation of cultural heritage amidst climate risks
Implementing Lead agencies:

NCIP, NCAA, NIH

Supporting agencies:

DoH, DepEd, DSWD

Select Key Strategies	Brief Description	Implementation Priority	Capital-intensiveness
Assess vulnerability of cultural heritage sites to climate risks	Conduct thorough assessments of cultural heritage sites, including detailed vulnerability maps, to pinpoint high-risk areas and prioritize preservation efforts	Immediate (0-3 years)	Medium
Integrate indigenous knowledge into climate risk assessments	Collaborate with indigenous communities to integrate traditional ecological knowledge, such as local climate patterns, adaptive practices, and sustainable resource management, into climate risk assessments	Immediate (0-3 years)	Medium



Develop and deploy culture-specific disaster preparedness	Develop disaster preparedness programs especially for indigenous communities impacted by climate change, that incorporate cultural values, practices, and community roles	Medium-term (3-6 years)	Medium
Activate community-led monitoring and protection	Empower indigenous communities to actively monitor and protect their heritage sites and ancestral land	Medium-term (3-6 years)	Medium
Develop culturally sensitive capacity-building programs to ensure job security of traditional workers	Create capacity-building programs tailored to the cultural context of traditional workers for new green jobs, aiming to secure their employment and livelihoods while protecting informal traditional livelihoods, where possible	Long-term (6+ years)	High



4.2.6 Land Use and Human Settlements

Overview of Land Use and Human Settlements in the Philippines

Land use and human settlements plays a vital role in the development and sustainability of the Philippines¹⁴⁵. From an economic perspective, the sector has far-reaching impacts on national prosperity and economic growth. Proper land use planning and settlement development reduces transportation costs and increases productivity, while sustainable land use practices can enhance agricultural productivity and support rural livelihoods. Moreover, well-planned human settlements can improve housing affordability, increase property values, and stimulate tourism, thus contributing to increased revenue streams for local economies and the country.

From a social standpoint, effective land use and well-planned human settlements contribute to improved quality of life for Filipinos. Properly designed urban and rural spaces can enhance community cohesion, provide access to essential services, and promote a sense of belonging. Decent infrastructure promotes social inclusion by providing housing for low-income families and marginalized communities. Additionally, thoughtfully managed land use can help preserve cultural heritage and protect natural ecosystems.

Today, this sector faces a myriad of challenges relating to capacity, land use, access to shelter and services, connectivity, equity and justice, and informality. For example, land use planning operates in a complex environment of mandates between various government agencies. Furthermore, land-use planning functions are carried out at different levels of the Philippine administrative hierarchy, and there are challenges to capacitate land use planning at local government levels.

In parallel, human settlements¹⁴⁶ are overburdened by rapid urbanization, with urban populations growing at 12% from 2015 to 2020¹⁴⁷. Rapid urbanization has contributed to increasing informal settlements in hazard-prone areas, increasing by 5.4%, with estimated 1.3 million informal settlers in Metro Manila alone¹⁴⁸ living in informal housing. Further, the pandemic has highlighted and compounded existing inefficiencies, inequities, and injustices in our settlement systems and placed setbacks in an already challenging path to sustainability.

Climate Change Impacts on Land Use and Human Settlements

There are two unique reasons as to why the Philippines' land use and human settlements are indisputably vulnerable to climate change. First, given the Philippines' archipelagic geography,

¹⁴⁵ Aligned with the Philippine Development Plan 2023-2028 and Resilient and Green Human Settlements Framework

¹⁴⁶ In line with the Resilient and Green Human Settlements Framework, human settlements are viewed as a system comprised of physical, natural, and social elements

¹⁴⁷ Philippine Statistics Authority. (2022). Urban Population of the Philippines (2020 Census of Population and Housing). Retrieved August 10, 2023, from <https://psa.gov.ph/content/urban-population-philippines-2020-census-population-and-housing>.

¹⁴⁸ UNESCO, UNDP, IOM, & UN-Habitat. (n.d.). Policy Briefs on Internal Migration in Southeast Asia: Overview of Internal Migration in Philippines. In bangkok.unesco.org.



60% of Philippine cities are located along the coast. As climate events become more frequent and increase in intensity, those living in the country's coastal areas and low-lying regions are especially susceptible to these hazards, which is home to an estimated 5.4 million people¹⁴⁹.

Second, rapid urbanization has contributed to divergences to planned land use and an increase in informal settlements in hazard-prone areas. An estimated 2.45 million impoverished Filipinos live in informal settlements, with ~40% concentrated within NCR¹⁵⁰. This means that future climate events disproportionately impact vulnerable populations, who have limited ability to withstand and recover from climate disasters.

Escalating climate change directly jeopardizes land and human settlements. For example, extreme sea levels such as storm surges are becoming more severe due to climate change, resulting in the inundation and flooding of coastal cities, settlements and infrastructure. Floods damage infrastructure, disrupt transportation networks, and affect land use patterns. Beyond sea level rise and extreme sea levels, the table below highlights the negative effects of other climatic impact-drivers on this sector.

Table 4.2.6.1 Impacts of climatic impact-drivers on Land Use and Human Settlements

Climatic impact-drivers	Impact to Land Use and Human Settlements
Sea level rise and extreme sea levels	Inundation of land & human settlements Extreme sea levels caused by storm surges and typhoons are becoming more severe due to climate change, resulting in the inundation and flooding of coastal cities, settlements and infrastructure. Infrastructure damage Flooding from sea level rise damages critical infrastructure, including roads, bridges, and buildings. Apart from residential infrastructure, coastal facilities like ports and airports are susceptible to the effects of rising sea levels and severe maritime events.
Extreme precipitation	Flooding & landslides lead to damaged human settlements and non-connectivity Intense rainfall events loosen earth structure and increase the risk of landslides and soil erosion, especially in mountainous and hilly regions. This threatens both land (agricultural land) and infrastructure.
Wind patterns and tropical cyclones	Damaged human settlements Cyclones and extreme winds often lead to mass displacement as homes and communities are destroyed. The affected population is forced to relocate, putting pressure on available resources and infrastructure in safer areas. Additionally, displaced populations often face compromised health due to limited access to

¹⁴⁹ Climate Central. (n.d.). Coastal Risk Screening Tool [Software]. <https://coastal.climatecentral.org>

¹⁵⁰ Navarro, A. M., Reyes, C. M., & Francisco, K. A. (2021). UN Common Country Assessment Update for the Philippines. <https://pidswebs.pids.gov.ph/>.



	clean water, sanitation, and medical services, while also experiencing heightened mental health challenges stemming from trauma, loss, and the stress of displacement. Infrastructure damage Cyclones and extreme winds can cause substantial damage to infrastructure, including buildings, roads, bridges, and power lines.

Among the various climatic impact-drivers, sea level rise is among the key climate risks that threatens land use and human settlements¹⁵¹. As sea levels rise, existing infrastructure, properties, and ecosystems become permanently inundated, disrupting urban development, and necessitating costly adaptations. By 2040, a projected 160 km² of land will be permanently inundated by sea level rise, with more than 30% of land in the National Capital Region at risk. Region III will see the most landcover exposed at 45 km². It may disproportionately impact coastal areas in Luzon such as Bulacan and Pampanga where there is land subsidence due to groundwater activity. This translates to an estimated 85,000 residential homes inundated by rising sea levels, many of which unaccounted for are informal settlements and coastal communities. Annualized damage of residential infrastructure could potentially reach PHP 7 billion in damages per year due to sea level rise.

Significant land areas in other regions may also become permanently inundated by rising sea levels. By 2060, a projected total of 380 km² of land across the country will be impacted, more than double compared to two decades before. Region III, Region IX, Region VI and Region VIII will each see an increase of more than 20 km² of land permanently inundated by rising sea levels versus 2040.

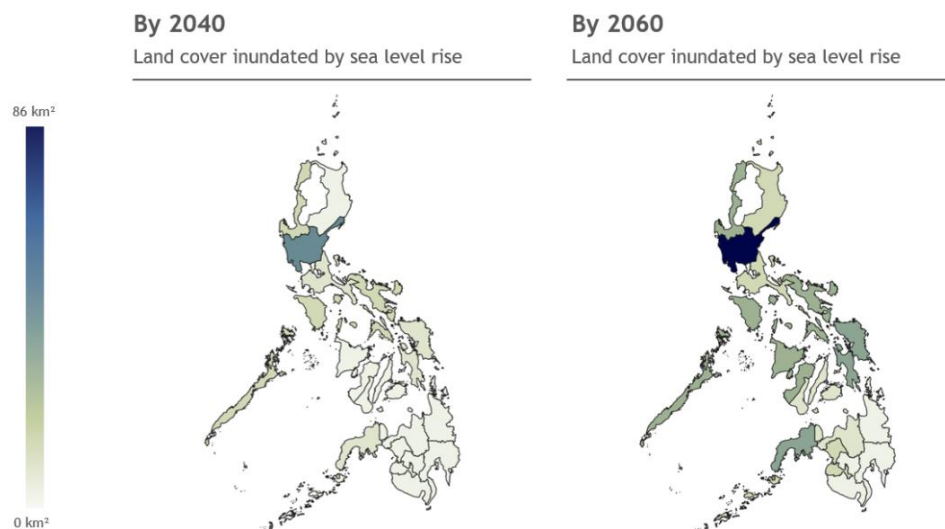


Figure 4.2.6.1 Projected inundated land cover (km²) due to sea level rise by 2040 and by 2060

¹⁵¹ Quantitative climate impacts outlined in this chapter are projected based on climate models developed as part of the National Adaptation Plan process. Detailed methodology for climate models per sector can be viewed on Appendix 2 – Land Use and Human Settlements



Wind patterns and tropical cyclones and pluvial flooding¹⁵² are also among the climatic impact-drivers that may threaten land use and human settlements. More than 80% of land (180,000 km²) is projected to be exposed to at least one Category 4 or Category 5 tropical cyclone in both the 2030 decade and 2050 decade, particularly in the north and east where there is more cyclone activity. Among most cyclone-prone regions, more than 90% of closed forests in Region II and Region VII are projected to be exposed. In Region V, more than 90% of grassland is also projected to be exposed to cyclones.

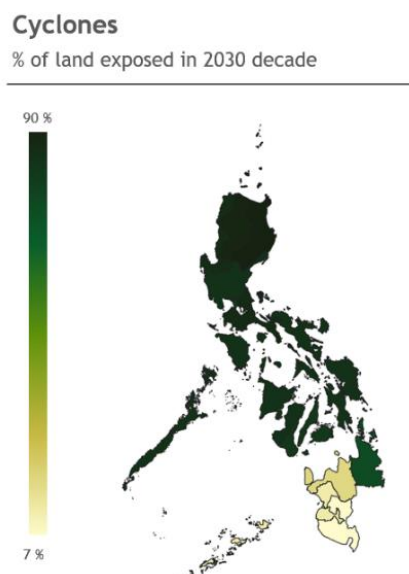


Figure 4.2.6.2 % land cover exposed to wind patterns and tropical cyclones in 2030 decade

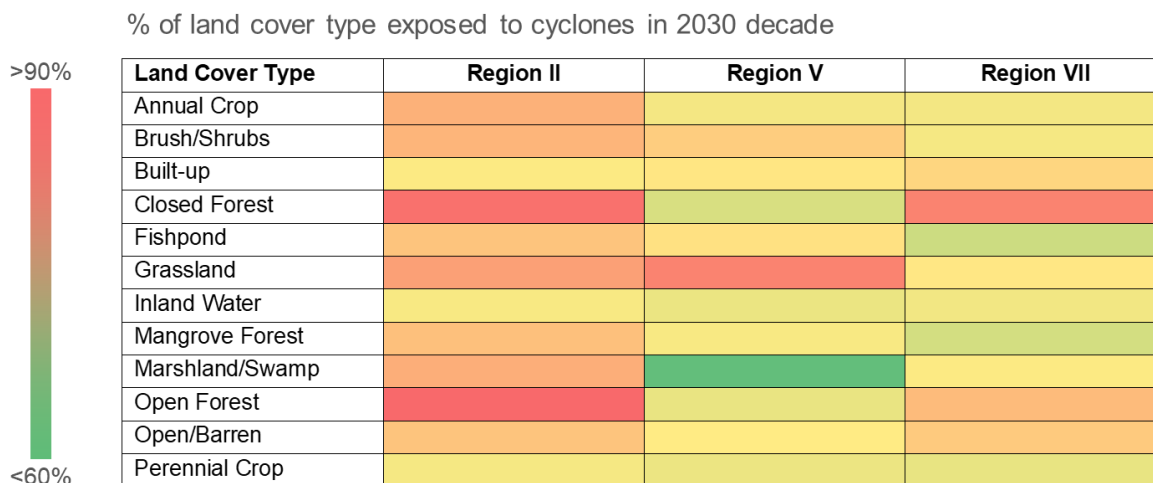


Figure 4.2.6.3 Heatmap of land cover types exposed to wind patterns and tropical cyclones in 2030 decade for select cyclone-prone regions

¹⁵² Pluvial, fluvial and extreme sea level-driven floods are modelled on a 10-year return period, represented by flood heights with a 10% chance of occurring in a year



Additionally, more than 55% of land is projected to be exposed to pluvial flooding in the 2030 decade, impacting about 170,000 km² of land. Particularly exposed regions are projected to include CAR (74%), Region II (67%), Region IV-A (66%) and Region V (66%). Areas in Luzon may also experience the most pluvial flooding due to inadequate drainage systems to meet the projected precipitation. An estimated 11 million residential homes will be exposed to pluvial flooding in this decade, particularly in CAR, where 70% of residential assets are projected to be exposed.

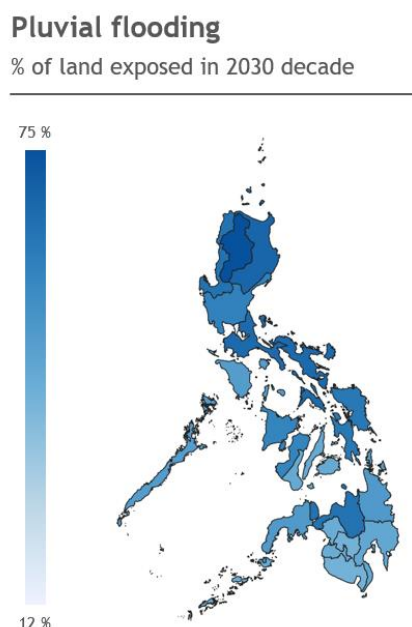


Figure 4.2.6.4 % of land cover exposed to pluvial flooding in 2030 decade

Notably, extreme sea levels are also among the most damaging to human settlements. While fewer residential homes are vulnerable to extreme sea levels when compared to other climatic impact-drivers, the magnitude of damage caused by flooding is notably higher. In the 2030 decade, PHP 67 billion of annualized damage to residential assets is projected due to extreme sea levels.

Exposure of land and human settlements to these climatic impact-drivers may risk widespread destruction, infrastructure damage, and displacement of communities. Looking at residential assets, an estimated PHP 225 billion in annual damage is projected from exposure to various climate risks. Consequently, the unpredictability of these occurrences presents heightened difficulties for local government land use planners in adhering to pre-existing plans, as they can undermine the suitability of land for development.

When considering priority adaptation solutions for the sector, actions must be taken to protect the most vulnerable populations: low-income communities residing along coastlines, informal settlements, persons with disabilities and indigenous peoples. Action must be taken to include economically disadvantaged populations residing in areas prone to flooding, cyclones, and other climate-related hazards due to limited housing options and inadequate infrastructure. Additionally, indigenous communities have strong cultural ties to specific land areas, making it critical to engage them in conversations to build for long-term resilience. Critical actions must address equity concerns by prioritizing these communities in resilience strategies.



Priority Adaptation Outcomes for Land Use and Human Settlements

Grounded on national policy anchors and existing programs related to this sector¹⁵³, the adaptation theme for Land Use and Human Settlements is **Data-Driven Land Use & Settlements: Conventionalizing Robust, Evidence-Based Planning**.

Three priority outcomes underpin this sector:

- 1. Data-driven, climate-focused land use and urban planning.** This outcome focuses on activating collaborative and interconnected risk-based planning and monitoring of land use across vertical and horizontal administrative areas. To enable this, the build-up of climate data at local levels is critical. Enabling access to dependable data will empower local land use and urban planning professionals. They will be able to proactively construct with resilience in mind and subsequently enhance existing settlements with effective solutions, all while having a clear understanding of the most affected areas and events.
- 2. Increased adaptive capacities of communities.** This outcome focuses on empowering and safeguarding vulnerable and disadvantaged populations by activating local leaders and the youth to participate in resiliency-building programs. However, in order for local communities to partake in these solutions, it is necessary for national and local actors to provide communities with revitalized housing and access to basic services for their own resilience.
- 3. Activated transformative multi-level climate governance.** This outcome focuses on ensuring sufficient capacity and capability for climate action at all levels. Beyond capacitating the adaptation agenda, this outcome aims towards activating a coordinated, participatory, and inclusive governance of climate priorities in relation to land use and settlements planning. This means providing avenues for voices of disadvantaged populations to partake in the shaping and implementation of adaptation solutions.

Priority Adaptation Strategies for Land Use and Human Settlements

Outcome 1: Data-driven, climate-focused land use and urban planning	
Implementing Lead agencies: DHSUD, DOST	Supporting agencies: DILG, NEDA, DENR, CCC

Select Key Strategies	Brief Description	Implementation Priority	Capital-intensiveness
Ensure access to comprehensible, open and shared climate information	Develop accessible, interoperable and centralized database of climate information for settlements planning, starting with providing policy support to capacitate LGUs, academe and other contributors to share and access climate data	Immediate (0-3 years)	High

¹⁵³ Refer to Appendix 3 – Land Use and Human Settlements to see list of policies and programs referenced as part of the NAP process



	(e.g., GHG emissions, biodiversity assessments and geohazard assessments)		
Enhance capacity development efforts and funding for LGUs to develop local climate assessments (e.g., Climate and Disaster Risk Assessment)	Deepen understanding and technical capacity of LGUs to be able to develop their CDRAs through necessary tools and platforms (digital, non-digital) and simplified guides to tie to national climate action plans	Immediate (0-3 years)	High
Enhance capacity support to LGUs to mainstream CDRA into local Comprehensive Land Use Plans (CLUPs)	Simplify guides and increase engagement with LGUs to determine implications of CDRA to local land use plans (e.g., priority decision areas based on risk evaluation, policy interventions / options with emphasis on Risk Management options, analysis of land supply and suitability-based climate change, and possible impacts on the severity and frequency of natural hazards)	Medium-term (3-6 years)	High
Mainstream nature-based solutions and resilience-focused urban planning and design	Strengthen promotion and incentivization of urban design strategies and nature-based solutions in alignment with LGU priorities	Medium-term (3-6 years)	Medium
Accelerate implementation of current policies in relation to land use and urban planning and climate risks (e.g., National Spatial Strategies, National Climate Risk Management Framework)	Implement programs under the NSS and NCRMF for improved population and urban planning, including the establishment of a database system for all human settlement assets and capital, bridging gaps in climate risk information, tools and methodologies and accelerating climate risk evaluation at local levels	Long-term (6+ years)	Medium

Outcome 2: Increased adaptive capacities of communities to increase resilience

Implementing Lead agencies:

Supporting agencies:



DHSUD, DILG	DOF, DENR, DOST, DOH, DPWH, DOTR, CCC

Select Key Strategies	Brief Description	Implementation Priority	Capital-intensiveness
Review and revise existing guidelines (e.g., Green Building Code, Batas Pambansa 220, PD 957) to improve standards and incorporate green and resilient technologies	Incentivize green and circular economy principles in housing programs and housing value chains at all levels (national, local, homeowner associates), while updating the relevant guidelines to incorporate climate and disaster-resilient strategies	Immediate (0-3 years)	Medium
Strengthen reliability of early warning systems and resilience of infrastructure in relation to hazardous climate events	Ensure systems and infrastructure (i.e., communications) are resilience-proofed to withstand climate hazards, especially for communities living in geographically isolated areas	Medium-term (3-6 years)	High
Strengthen capacity of stakeholders to understand, decide and act on warning messages and forecasts	Adopt a needs-based approach in providing capacity training and development for community participation in relation to hazardous climate events	Medium-term (3-6 years)	Medium
Knowledge building on sustainable community and housing design and community-based disaster preparedness	Conduct training and capacity building activities to build knowledge on green & sustainable housing design and community-based protection particularly around DRR-CCA, (e.g., biomimicry in urban design)	Medium-term (3-6 years)	Medium

Outcome 3: Activated transformative multi-level climate governance

Implementing Lead agencies: DHSUD, DILG, DOF	Supporting agencies: NEDA, DICT, Philippine Space Agency, DOST, DPWH, DOTR, CCC, CHED

Select Key Strategies	Brief Description	Implementation Priority	Capital-intensiveness
Strengthen inter-LGU collaboration and inclusive participatory planning	Facilitate best practice sharing among LGUs, particularly utilizing LGUs that have already successfully implemented climate	Immediate (0-3 years)	Medium



	programs as resource for other LGUs		
Establish formal coordination platforms between local university and state colleges for climate action	Establish linkages with local university and state colleges who can provide access to localized data and research, and/or provide capability support to land use and urban planning	Immediate (0-3 years)	High
Establish formal PPP mechanisms and platforms	Encourage PPPs and cross-sector collaboration in the creation, review and update of local land use plans and urban settlement planning	Medium-term (3-6 years)	Medium
Increase access to PSF and other climate finance	Increase access to local and international climate finance, in particular investments for social preparation and capacity building for stakeholder groups	Medium-term (3-6 years)	Medium



4.2.7 Livelihoods and Industries

Overview of Livelihoods and Industries in the Philippines

Livelihoods and Industries is a key pillar to the sustainable economic and social development of the Philippines. In the context of the NAP, livelihoods and industries refer to key economic sectors and the employment associated with these key sectors. The Philippines envisions a revitalized industries sector, with focus on expanding the domestic market and supplier base, moving up the value chain, and enhancing linkages across sectors. For services, the Philippines envisions a shift from its current low productivity level to become a modern, productive, and resilient global leader providing higher value-adding and differentiated services¹⁵⁴. From an economic perspective, industries and services provide a significant portion of employment opportunities for Filipinos. Provided that a large portion of the population relies on informal and low- to medium-skilled work, strengthening resilience in this sector can lead to sustainable employment opportunities and income generation, especially in less developed areas in the country.

From a social perspective, diversified industries can contribute to community resilience and social stability. More importantly, in line with the Philippines' focus to improve accessibility of micro, small, and medium enterprises (MSMEs) to a dynamic science, technology, and innovation ecosystem, supporting local entrepreneurs fosters a culture of innovation and encourages social mobility.

Today, industries and services continue to recover from COVID-19 slowdowns¹⁵⁵. In the first half of 2022, economic recovery has become more broad-based as many industry sub-sectors have surpassed pre-pandemic performance. As a result, employment has also rebounded given sustained economic momentum. However, certain challenges continue to face this sector.

For example, despite many businesses turning to digital tools over the pandemic, manufacturing businesses continue to have low technology utilization, due to high cost of technologies, lack of infrastructure, absence of skilled employees and lack of management knowledge. These challenges will equally underlie future efforts for climate adaptation.

Within services, which includes tourism and professional services, the sector continues to be dominated by low-paying jobs concentrated in low-skills domestic services. Constraints to increasing productivity include lack of access to reliable and advanced information and communications technology (ICT) infrastructure, lack of access to markets and capital, and mismatch in skills and lack of skilled talent for niche job roles. Ultimately, businesses will be challenged to consider climate resilience in their plans as resources will focus on recovery and immediate growth.

¹⁵⁴ National Economic and Development Authority. (2023). Philippines Development Plan 2023-2028. In National Economic and Development Authority. Retrieved August 14, 2023, from <https://pdp.neda.gov.ph/philippine-development-plan-2023-2028/>

¹⁵⁵ National Economic and Development Authority. (2023). Philippines Development Plan 2023-2028. In National Economic and Development Authority. Retrieved August 14, 2023, from <https://pdp.neda.gov.ph/philippine-development-plan-2023-2028/>



Climate Change Impacts on Livelihoods & Industries

Two key considerations are focal to the discussions on climate change impacts on Livelihoods & Industries. First, resilience in key industries in the Philippines must be built to protect the country's economic and social stability amidst increasing climate hazards. Focus must be placed on climate adaptation priorities, to protect key industries that contribute heavily to our GDP¹⁵⁶, particularly: Manufacturing (17.2%), Tourism (6.2%) and Professional Services (6.1%)¹⁵⁷. In this regard, we protect livelihoods of over 12 million Filipinos¹⁵⁸ who rely on these industries.

Second, more than 95% of establishments in the Philippines are MSMEs¹⁵⁹. MSMEs often operate with limited financial and technical resources compared to larger corporations, and as such have fewer capacities to invest in climate-resilient infrastructure, technology, and adaptation measures. In addition, many MSMEs rely heavily on informal labor with limited access to social protection, making them more susceptible to income losses during climate-related disruptions. Therefore, it will be critical for adaptation priorities to equip MSMEs with the proper resources and regulatory support to be able to plan for climate resilience.

Climate change has wide-ranging impacts on key industries, in turn impacting livelihoods of Filipinos. For example, in the manufacturing sector, critical industry infrastructure can be inundated or damaged by extreme weather events, leading to disruptions in production and supply chains. As a result, economic losses and decreased manufacturing output will occur.

The tourism sector, which is a major source of employment, is vulnerable to sea-level rise and changing weather patterns, impacting coastal communities that rely heavily on tourism-related activities for their livelihoods. Increased temperatures can also impact tourism workers, who are disproportionately exposed to outdoor environments.

In the professional services sector, waterlogged areas from extreme rainfall and tropical storms can cause temporary closures, impacting temporary or permanent loss of livelihoods for service workers.

The table below highlights some of these negative impacts:

Table 4.2.7.1. Impacts of climatic impact-drivers on Livelihoods & Industries

Climatic impact-drivers	Impact to Livelihoods and Industries
Sea level rise and extreme sea levels	Inundated industry enablers and infrastructure Manufacturing facilities located in coastal areas are at risk of damage from storm surges, flooding, and coastal erosion. Disruptions in production and

¹⁵⁶ Agriculture is also a key industry contributing 9% of Philippine GDP, and is covered as a separate priority sector under the National Adaptation Plan

¹⁵⁷ Labor Force Survey. (2023). [Dataset]. Philippine Statistics Authority. <https://psa.gov.ph/statistics/labor-force-survey>

¹⁵⁸ Annual Gross Domestic Product. (2022). [Dataset] Philippine Statistics Authority. <https://www.psa.gov.ph/statistics/national-accounts>

¹⁵⁹ 2021 MSME Statistics. (2021). [Dataset] Department of Trade and Industry. <https://www.dti.gov.ph/resources/msme-statistics/>



	supply chains can result in economic losses and decreased manufacturing output. Climate hazards damage infrastructure that services, including hospitality, retail, and transportation, are reliant upon. For example, sea level rise contributes to the erosion of coastlines and loss of beaches, which are significant attractions for tourists. This reduces the appeal and competitiveness of coastal destinations, impacting tourism revenue. Loss of livelihood As a result of these events, Filipinos relying on these industry activities may lose their homes, access to livelihoods, and cultural ties to their land. Vulnerable communities are particularly at risk due to lesser social mobility and limited ability to recover.
Increased temperature and droughts	Reduced productivity across industries For manufacturing, higher temperatures increase the demand for cooling¹⁶⁰, resulting in increased energy consumption and operational costs for manufacturing facilities. Research suggests that, on average, a one degree increase in ambient temperature can result in a 0.5–8.5% increase in electricity demand¹⁶¹. Within services, particularly tourism, higher temperatures can lead to heat-related health issues, impacting the well-being of workers and affecting productivity.
Extreme precipitation Wind patterns and tropical cyclones	Damaged industry enablers and infrastructure, reduced incomes Heavy rains and flooding can disrupt transportation routes, causing delays and interruptions in the delivery of raw materials and finished goods, disrupting supply chain and affecting manufacturing operations. Waterlogged areas from extreme rainfall and tropical storms can result in temporary closures or reduced customer traffic for businesses in the service sector. Restaurants, hotels, and retail establishments in flood-prone areas experience reduced customer footfall and disruptions in operations.

¹⁶⁰ Cooling through creation of green spaces or other nature-based solutions as opposed to airconditioning

¹⁶¹ World Bank Group & Asian Development Bank. (2021). Climate Risk Country Profile - Philippines. In World Bank. Retrieved August 14, 2023, from <https://climateknowledgeportal.worldbank.org/>



Increased temperatures and droughts are projected to impact labor productivity in these key sectors^{162,163}. PHP 36 billion in productivity losses is projected for the manufacturing industry while an additional PHP 2 billion in productivity losses is projected for professional services resulting from extreme heat in the 2030 decade. Within manufacturing, labor productivity in Region IV-A, Region III and NCR will be most impacted. This correlation is aligned provided majority of manufacturing activities are concentrated within these regions. Meanwhile, within professional services, labor productivity in NCR and Region VII will be most impacted.

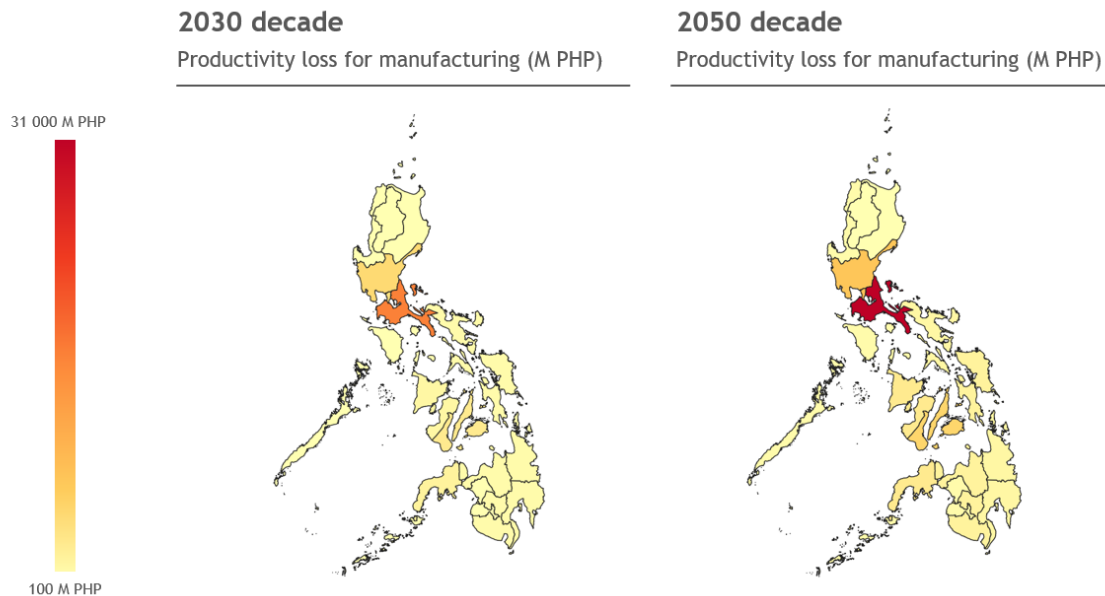


Figure 4.2.7.1 Value of labor productivity loss per region in the 2030 decade and 2050 decade for Manufacturing

¹⁶² Labor productivity losses for tourism has not been quantified as workers are subsumed across various industries (e.g. wholesale & retail trade, agriculture, forestry and fishery, real estate activities, etc.). It is worth noting that many workers in the tourism industry, especially in nature tourism, are exposed to extreme heat due to the outdoor nature of work

¹⁶³ Quantitative climate impacts outlined in this chapter are projected based on climate models developed as part of the National Adaptation Plan process. Detailed methodology for climate models per sector can be viewed on Appendix 2 and Appendix 3 – Livelihood and Industries

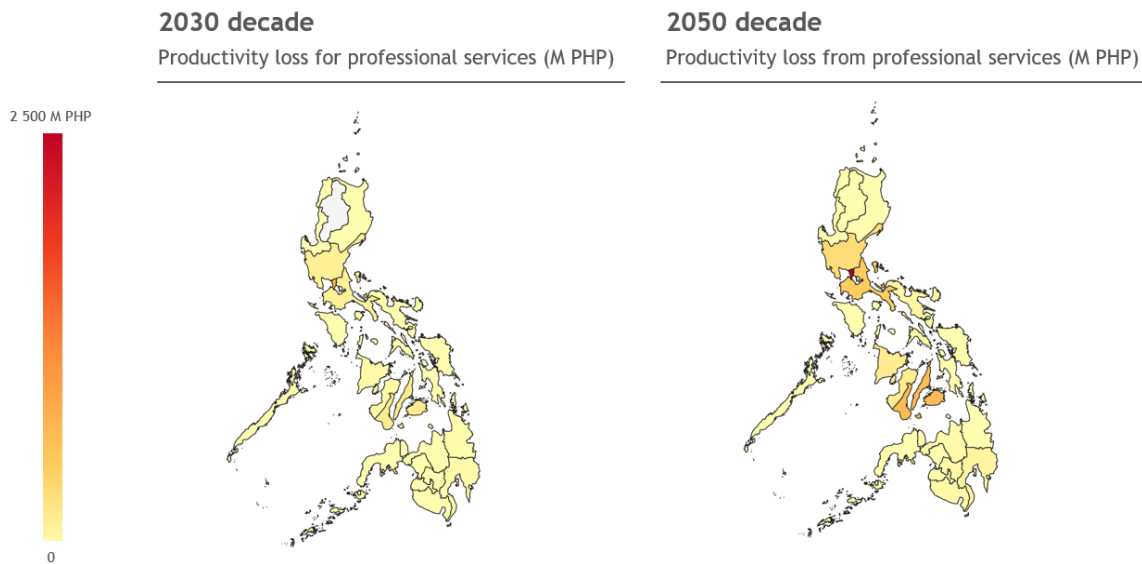


Figure 4.2.7.2 Value of labor productivity loss per region in the 2030 decade and 2050 decade for Professional Services

Among the various climatic impact-drivers, exposure to wind patterns and tropical cyclones is among the key climate risks that threaten critical infrastructure across key industries¹⁶⁴. Overall, 5% of key industry infrastructure is projected to be exposed to at least one Category 4 or Category 5 cyclone in the decade of 2030. Within the national context, the total exposure of industry infrastructure is attributed significantly to exposure of infrastructure in Region IV-A (25%), Region III (18%), and the National Capital Region (13%), owing to the concentration of industry hubs in these areas. Annualized damage of infrastructure could potentially reach PHP 22 billion in damages per year due to cyclones and extreme winds.

Of the projected damages per year, PHP 16 billion is attributed to damages to professional services infrastructure, while PHP 4.5 billion is attributed to damages to manufacturing infrastructure. Although most manufacturing and professional services infrastructure is constructed to endure powerful winds and heavy rainfall, prolonged exposure to such occurrences can gradually erode their resilience. Furthermore, it is imperative to consider the facilities owned by Micro, Small, and Medium Enterprises (MSMEs) within these industries. These enterprises often face greater challenges in terms of repairing and recuperating from such damages.

In addition, exposure of manufacturing infrastructure (6%) and professional services infrastructure (5%) to cyclones and extreme winds can result in significant and wide-ranging impacts on both operational efficiency and economic stability. Beyond physical damage, production and supply chain disruptions, equipment loss, and workforce disruption also threaten the stability of this sector.

Adaptation plans must also exercise vigilance concerning tourism infrastructure (5%), as it often exhibits a heightened degree of fragility compared to other infrastructure. Many tourist destinations

¹⁶⁴ Socioeconomic impact modelling considers select points of interest for key industries: Manufacturing: Warehouses and factories; Tourism: Hotels, restaurants, tourism spots and religion spots; Professional services: Banks, commercial buildings, and offices



are characterized by their ecological and natural attributes, rendering them inherently susceptible and prone to vulnerabilities.

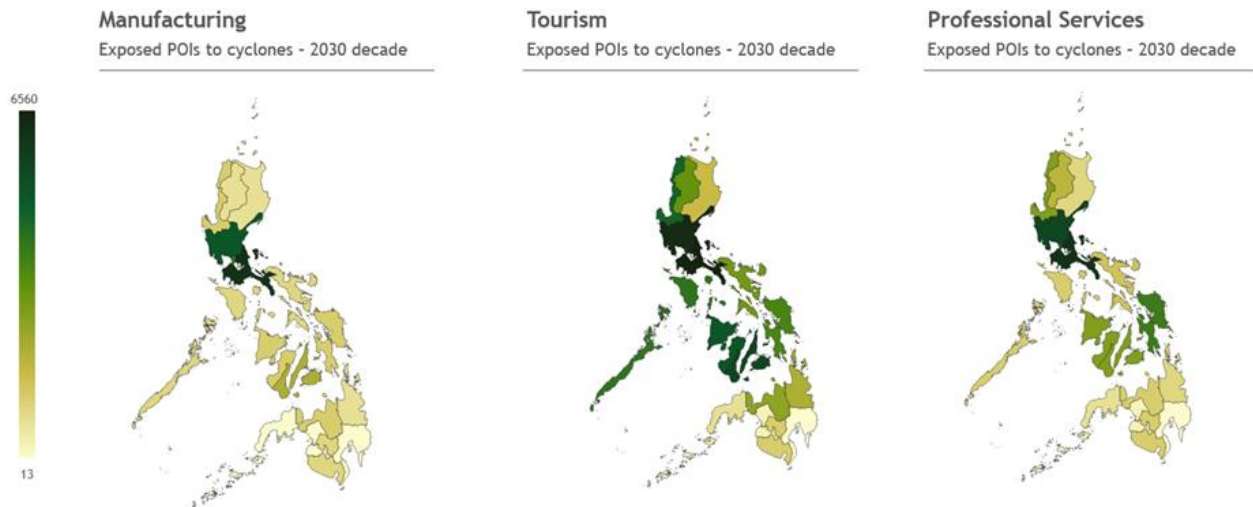


Figure 4.2.7.3 Exposed points of interest across various industries in the 2030 decade

Beyond damage to industry infrastructure and consequent disruptions in operations, it is imperative to consider the impact to livelihoods and well-being of Filipino workers. The continuity of industries is intrinsically linked to the stability of employment opportunities, income streams, and social support systems that sustain the workforce. The ripple effects of disrupted operations can extend to families, communities, and the broader economy, underlining the significance of safeguarding not only industrial assets but also the economic security and dignity of the labor force.

Priority Adaptation Outcomes for Livelihoods and Industries

In line with the long-term Philippines' vision to revitalize industry and reinvigorate services¹⁶⁵, the adaptation theme for Livelihoods & Industries is **Embrace Resilience: Fortifying Industry for Economic Prosperity.**

Three priority outcomes underpin this strategy:

- 1. Key industry infrastructure and production facilities protected.** This outcome focuses on implementing comprehensive risk assessments to identify potential vulnerabilities across critical industry-related infrastructure. Protection of these key infrastructures ensures the continuity and resilience of essential industries that underpin the Philippine economy.
- 2. Due diligence in regulations and worker protections enhanced, for climate resilience of workers.** This outcome focuses on enacting adaptive strategies to safeguard workers' well-being and livelihoods from the impacts of climate-related hazards. Reviewing worker practices and

¹⁶⁵ Refer to Appendix 3 – Livelihoods and Industries to see list of policies and programs referenced as part of the NAP process



regulations should especially focus on MSME workers who may not have the resources to resist and adapt to climate-related risks. Where there are co-benefits between mitigation and adaptation, consideration of opportunities for green jobs is also a focus area.

- 3. Continuity of industry operations and productivity sustained amidst climate risks.** This outcome focuses on ensuring business continuity and safeguarding operations (e.g., supply chains) from the impacts of climate-related hazards, especially for MSMEs. Second-level effects of climate hazards are expected, including susceptibility of supply chains to climate-related disruptions, which in turn may lead to revenue losses and reduced production outputs.

Priority Adaptation Strategies for Livelihoods and Industries

Outcome 1: Key industry infrastructure and production facilities protected	
Implementing Lead agencies: DTI, DoT	Supporting agencies: DPWH, NEDA, DILG

Select Key Strategies	Brief Description	Implementation Priority	Capital-intensiveness
Standardize assessment of climate risks across key industry infrastructure	Provide industry players with a suite of tools (e.g., clear guidelines and requirements, access to climate impact data, etc.) to partake in climate risk assessments to identify potential climate risks on end-to-end value chain; capacity building needed to support MSMEs	Immediate (0-3 years)	Medium
Broaden roll-out of incentivization programs to reinforce critical infrastructure at risk	Widen reach of incentive mechanisms that encourage private sector to include climate de-risking as part of business priorities; ensure provision of support mechanisms for MSMEs	Immediate (0-3 years)	High
Mainstream use of climate-resilient design and nature-based solutions, where possible, among industry players	Reinforce infrastructure with climate-resilient design, including nature-based solutions, where possible, to mitigate the impacts of climate hazards and ensure continuity of operations	Medium-term (3-6 years)	High
Activate and widen access to funding sources for public and	Enhancing access to climate finance mechanisms, such as climate funds, grants, loans and sustainable finance, to support	Medium-term (3-6 years)	High



private sector to invest in green infrastructure	climate adaptation initiatives across industries		

Outcome 2: Due diligence in regulations and worker protections enhanced, for climate resilience of workers

Implementing Lead agencies:
DOLE, DTI

Supporting agencies:
TESDA, NEDA, DepEd

Select Key Strategies	Brief Description	Implementation Priority	Capital-intensiveness
Develop sector-specific guidelines for treatment and handling of workers in relation to climate change	Foster partnerships between government bodies, industry associations, and private enterprises to review regulations to protect workers from climate-related risks, such as worker safety during extreme weather events, and develop industry-specific guidelines for the protection of workers	Immediate (0-3 years)	Medium
Incorporate climate resiliency topics into organizational learning programs and academic curriculums	Integrate climate resilience topics into organizational learning programs and trade / vocational curriculums to educate workers on protection against climate hazards in the workplace	Medium-term (3-6 years)	Medium
Enhance capacity building and training of climate-resilient skills (e.g., programs under National Green Jobs Human Resources Development Plan)	Provide training and capacity-building programs to enhance the knowledge and skills of workers on climate-resilient practices, including reskilling workers from industries phased out due to climate change	Medium-term (3-6 years)	High
Ensure funding and capacity to activate social protection for impacted workers (e.g., DOLE DILEEP)	Implement programs to provide support and assistance to individuals who may experience job loss or economic disruptions due to climate-related impacts or the transition to a climate-resilient economy	Medium-term (3-6 years)	High


Outcome 3: Continuity of industry operations and productivity sustained amidst climate risks
Implementing Lead agencies:
DTI

Supporting agencies:
DOLE, NEDA

Select Key Strategies	Brief Description	Implementation Priority	Capital-intensiveness
Scale awareness programs to educate industries on best-practice adaptation strategies	Educate industries on best-fit adaptation strategies (e.g., specific to industry context) to deepen understanding of climate change impacts	Immediate (0-3 years)	Medium
Require adaptation planning amongst private sector businesses, including continuity planning & disaster response plans	Mandate adaptation plan development to assess and address climate risks, supported by clear guidelines and access to climate data for decision-making	Immediate (0-3 years)	Medium
Create avenues to allow for value chain integration and market linkages for small scale producers	Create nationwide programs to support diversification and redundancy in supply chains to minimize the risk of disruptions caused by climate-related events, particularly through involving MSMEs	Medium term (3-6 years)	High
Create incentives for private investment in nature-based solutions	Create formal incentive platforms supported by strengthened policies and simplified mechanisms for private sector access, to encourage adoption of nature-based adaptation solutions	Medium term (3-6 years)	High



4.2.8 Energy, Transport and Communications

Overview of Energy, Transport, and Communications in the Philippines

Critical services such as Energy, Transport, and Communications systems, which make up the remaining key physical infrastructure¹⁶⁶ in IPCC AR6, are vital components to enabling socioeconomic development, highlighted by their inclusion within the Philippine Development Plan (2023-2028). These infrastructures are facilitators of economic growth - ensuring the efficient, uninterrupted operation across industries, while enabling the distribution and consumption of goods and services produced.

Energy systems empower industries, businesses, and households, transportation infrastructure provide channels for the movement of goods and manpower, and communications systems enable transfer of information and services, which in turn facilitates trade and investment activities. Socially, access to a reliable source of energy uplifts the quality of life of communities by providing access to a wide array of services for well-being, such as lighting, cooking, and cooling. Accessible transport infrastructure enhances connectivity across the country, connecting rural areas to urban centers and improving access to basic services, such as education, healthcare, and markets. Communication unlocks many of the same services as transportation and goes beyond, enabling virtual access to key systems and services.

This sector presently faces a myriad of challenges that impedes secure and reliable access to across the Philippines. The rapid growth of the Philippine population alongside the expansion of demand per capita for services related to Energy, Transport, and Communications infrastructure has contributed to issues with capacity across all three infrastructure systems. Within energy, this can be seen through the fact that 5% percent of Filipino households still live without electricity¹⁶⁷, pointing towards a network lacking in breadth. Compounding this is the expectation for national electricity consumption in 2040 to nearly quadruple from 2019 numbers according to AmBisyon Natin 2040, while the Malampaya gas reserve, which supplies almost of third of electricity in Luzon, is facing impending depletion¹⁶⁸. Within transport, the mobility of many Filipinos is hindered by the inadequacy of transportation facilities – inefficient, inconvenient transit systems, and poor last mile connectivity discourage private motorists from utilizing public mass transportation, while many of the Philippines's rail systems are operating in a state of overcapacity today, according to ADB¹⁶⁹. Communications systems are no exception to this – currently the nation has 164 towers per 1 million people, one of the lowest ratios in the region. An additional 60,000 towers on top of the current 27,000 are expected to be required by 2031 for unserved and underserved communities¹⁷⁰.

¹⁶⁶ Other key physical infrastructure – water & sanitation, waste, built form, are covered in other sectors in this NAP & NCCAP

¹⁶⁷ Department of Energy. (2022). 2021 Philippine Energy Situationer

¹⁶⁸ National Economic Development Authority. (2016). AmBisyon Natin 2040

¹⁶⁹ ADB. (2021). Accessibility Analysis of the South Commuter Railway Project of the Philippines

¹⁷⁰ ADB (2022). ADB, Tiger Infrastructure Sign \$40 Million Loan to Support Rural Connectivity in Southern Philippines



Challenges exist on the institutional plane as well, with outdated policies and program implementation challenges hindering the improvement of the sector's situation. The lack of available data also hinders execution – for example, there is limited transport-related data, largely driven by a lack of regular survey and data collection initiatives, that has caused difficulty in the implementation of the National Transport Policy¹⁷¹.

Climate Change Impacts on Energy, Transport, and Communications

Climate change will further exacerbate vulnerabilities within the Energy, Transport, and Communications sector, as it impacts both the infrastructure of these services and influence the demand profile for services across these systems.

Energy, Transport, and Communications infrastructure are inherently vulnerable to climate hazards, but poor construction and placement in vulnerable areas exacerbates this further. According to the ND-GAIN index¹⁷², the Philippines is among the top tercile of countries in terms of infrastructure vulnerability to climate change, and for transportation, the WEF ranked the Philippines's road, seaport, airport, and railroad infrastructure quality amongst the bottom quintile globally¹⁷³. The results of this vulnerability have been witnessed time and time again historically, such as when during the Typhoon Odette in 2021, where in over a third of seaports were put out of operations and access to communication services was hampered across multiple municipalities for six weeks, disrupting supply chains, logistics, while hampering disaster relief and recovery operations¹⁷⁴.

Rising temperature, coupled with the growing population and digitalization is expected to influence demand across Energy, Transport, and Communications services – additionally, increased temperature will likely lead to less efficient hardware systems. This is particularly true for Energy systems, evidenced by past incidences such as the 2019 heatwave which caused shortages due to reduced cooling capacity of the Calaca Coal-fired power plant¹⁷⁵, or the 2015 El Niño event which reduced hydroelectric power output and necessitating the implementation of power rationing¹⁷⁶.

If left unattended, intensifying climate change will continue to negatively impact Energy, Transport and Communications infrastructure. For example, extreme events such as storm surges, typhoons, and floods are projected to become more severe due to climate change, resulting in the inundation of infrastructure from sea level rise or damage from flooding or landslides, likely leading to disruptions in service provision. Increased temperature and drought are expected to influence the demand profile for services provided by these systems, while potentially reducing

¹⁷¹ National Economic Development Authority. (2022). Philippine Development Plan 2023-2028

¹⁷² The University of Notre Dame Global Adaptation Initiative (2022). Notre Dame, United States. Available at: <https://gain.nd.edu/our-work/country-index/>

¹⁷³ World Economic Forum, Global Alliance for Trade Facilitation. (2016). The Global Enabling Trade Report 2016

¹⁷⁴ National Economic Development Authority. (2022). Philippine Development Plan 2023-2028

¹⁷⁵ Vilanueva, J. (2019). Power grid operations back to normal: NCGP. Philippine News Agency

¹⁷⁶ Teves, C. (2019). El Niño can force Mindanao power rationing. Philippine News Agency



efficiency of infrastructure. Beyond these impacts, the table below outlines the adverse effects of different climate drivers across the Energy, Transport, and Communications sector.

Table 4.2.8.1. Impacts of climate hazards on Energy, Transport, and Communications

Climatic driver	impact-	Negative effects to the Energy, Transport, and Communications sector
Increased temperature and Drought		Less efficient systems and vulnerable infrastructure Higher temperatures lead to increased demand for cooling, both across consumers and for critical infrastructure themselves, such as in powerplants and data centers, which puts pressure on electricity supply. This results in higher energy consumption during heatwaves and can strain the power grid. Additionally, the increased demand for cooling from infrastructure itself, coupled with the availability of cooling water potentially decreasing, may reduce the efficiency and performance of power plants and data centers. This can result in reduced output or the need for operational adjustments. Damaged infrastructure and disrupted service Increased temperature can cause transmission lines to expand, sag, or overload due to increased electrical resistance. These constraints can lead to power disruptions and impact the reliability of electricity supply. Increased temperature also poses significant risks to the transport infrastructure sector in the Philippines, particularly in terms of road surfaces, railway tracks, and airport operations. High temperatures can cause thermal expansion of pavement materials, resulting in pavement deformations and cracks. Moreover, extreme heat can affect railway tracks, causing buckling and disruptions in train services.
Sea level rise and extreme sea levels		Damaged infrastructure and disrupted services Rising sea levels raise the risk of coastal flooding, which can damage or inundate critical infrastructure such as power plants, substations, and transmission lines within energy, coastal roads, bridges, and seaports within transportation, and towers, cables, and base equipment for communications. This damage could result in the disruption of services, especially if infrastructure impacted is a critical node within network. In addition, as sea levels rise, saline water can infiltrate freshwater sources and aquifers, threatening the water supply needed for thermal power plant operations. Saltwater intrusion can corrode equipment and compromise the efficiency of cooling systems, leading to operational challenges.
Extreme precipitation		Damaged infrastructure and disrupted services Extreme precipitation events pose a substantial risk across Energy, Transport, and Communications infrastructure in the Philippines, particularly through the occurrence of floods, landslides, and associated damages.



	These events can lead to road closures, bridge collapses, flooding of substations, ducts, cabinets, and cables, potentially leading to the disruption of services.
Wind patterns and tropical cyclones	Damaged infrastructure and disrupted services Wind patterns and tropical cyclones can cause extensive damage to across Energy, Transport, and Communications infrastructure, including transmission lines, distribution networks, substations, and turbines within Energy, roads, bridges, ports, and airports for Transport, and aerial components of communications network such as poles, exposed wires and cables, towers, and masts. Damage to these can lead to disruptions in services.

Across this sector, Region IV-A constantly finds itself amongst the most impacted regions, likely driven by the quantity of infrastructure to support its sizeable population.¹⁷⁷

Energy infrastructure expected to be most affected by pluvial flooding, cyclones, and sea level rise. Across the decade of 2030-2040, 8% of energy infrastructure, composed of electric lines and poles, substations, and generators, are projected to be exposed to extreme climate events, composed mostly of pluvial floods and cyclones. The direct damage caused by these climate hazards are projected to stand at over 3B PHP annually from 2030-2040, with more than half of the damage generated within Regions IV-A, III, and NCR, listed in descending absolute damage. Within this decade, pluvial flooding and cyclone damage are expected to be responsible for 70% of damage annually.

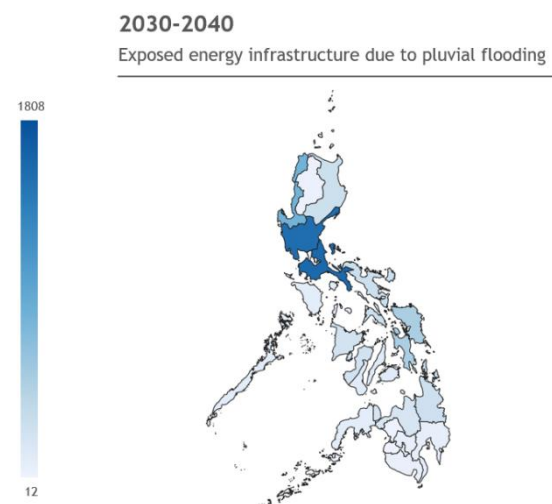


Figure 4.2.8.1 Energy infrastructure exposed to pluvial flooding between 2030-2040, SSP5-8.5

Transport infrastructure expected to be most damaged by pluvial flooding across the nation. Across the decade of 2030-2040, 5% of transport infrastructure, composed of roads, bridges, railways, airports, seaports, and other transport terminals, are projected to be exposed to climate hazards, a majority of which will be composed of pluvial floods. The direct damage caused by these climate hazards is expected to stand at ~32B PHP annually from 2030-2040, with Region IV-A and V receiving approximately half of the damage. In this decade, pluvial flooding alone is expected to cause over 20B PHP of damage annually, more than half of the damage sustained by transportation infrastructure. Of note, while pluvial flooding-driven damage is projected to compose almost three-quarters of damage

¹⁷⁷ Quantitative climate impacts outlined in this chapter are projected based on climate models developed as part of the National Adaptation Plan process. Detailed methodology for climate models per sector can be viewed on Appendix 2 and Appendix 3 – Energy, Transport and Communications

observed in Region IV-A, over 60% of Region V's transportation infrastructure damage observed is expected to be caused by extreme sea levels and sea level rise – in fact, transportation infrastructure within Region V is expected to face over two-thirds of the damage caused by sea level rise.

In the decade of 2050, transport infrastructure exposure is projected to increase by 1%, from 5% to 6%, but damages are expected to increase disproportionately by close to 10% to over 38B PHP per annum, with half of the damage projected to remain in Regions IV-A and V. The relative composition of damage across hazards within regions are expected to follow the trends observed nationally, with Region IV-A's damage profile heavily indexed towards fluvial flooding, while Region V sees a vast majority of damage stemming from extreme sea levels and chronic sea level rise.

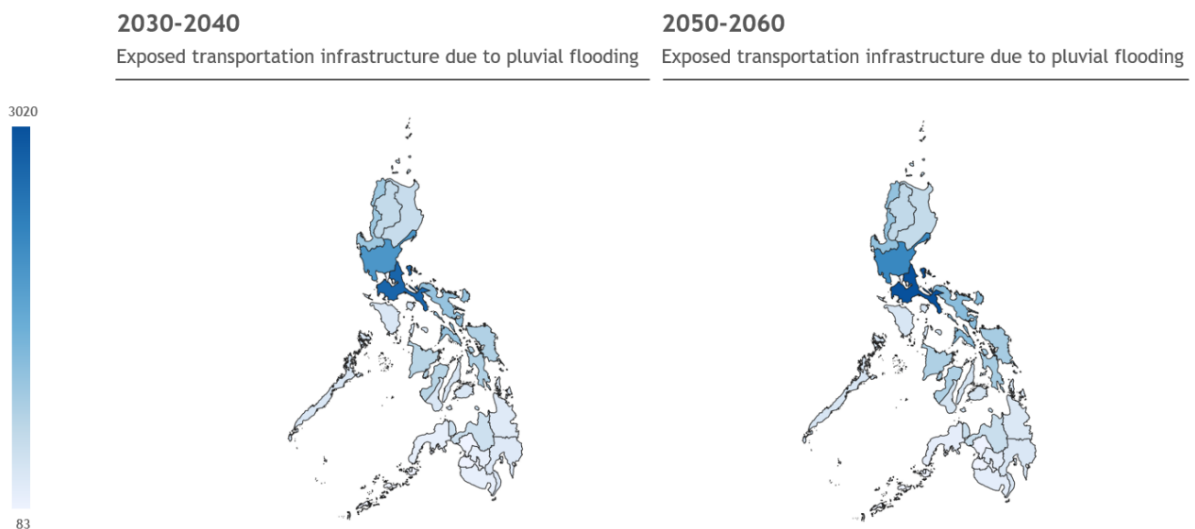


Figure 4.2.8.2 Transport infrastructure exposed to pluvial flooding between 2030-40, 2050-60, SSP5-8.5

Communications infrastructure expected to be most impacted by cyclones across the nation.

Across the decade of 2030-2040, 15% of communications infrastructure, composed of telecom towers and data centers, are projected to be exposed to climate hazards, mostly composed of cyclones and pluvial flooding. The direct damages caused by these climate hazards is expected to stand at approximately 350M PHP annually from 2030-2040, with more than 60% of the damage caused within Region IV-A. Across this decade, two-thirds of the damage is expected to stem from cyclones.

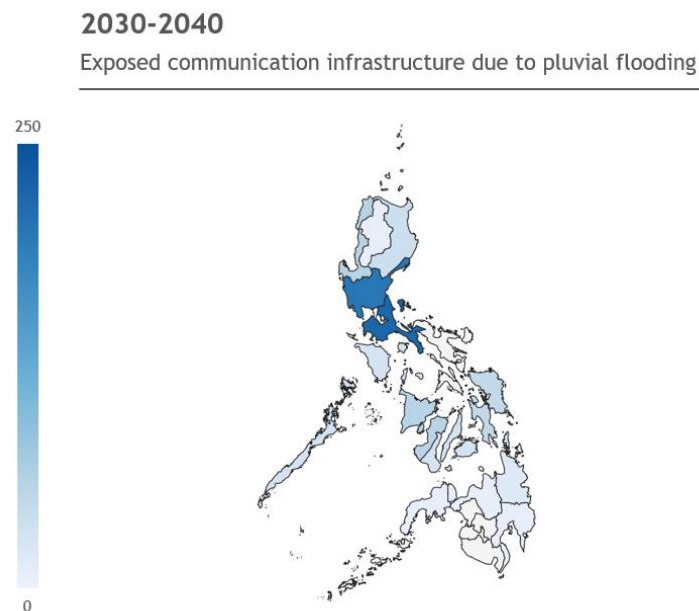


Figure 4.2.8.3 Communication infrastructure exposed to pluvial flooding between 2030-40, 2050-60, SSP5-8.5

Priority Adaptation Outcomes for Energy, Transport, and Communications

Grounded on national policies and existing programs related to this sector¹⁷⁸, the adaptation theme for Energy, Transport, and Communication is **Protect Critical Assets: Secure Access &**

Two priority outcomes underpin this strategy:

- 1. Comprehensive planning and response mechanisms established across energy, transport, and communication infrastructure.** This outcome focuses on building structural and geographic resilience into infrastructure systems aligned with policies and planning procedures, while implementing monitoring and response mechanisms to minimize disruptions. To achieve this outcome, regular baselining and data collection exercises must be performed to inform policies, and sufficient government support must be provided for initiatives.
- 2. Sufficient capacity of energy, transport, and communication infrastructure services to meet evolving demand induced by climate change.** This outcome focuses on addressing changing demands for critical infrastructure services caused by climate change through scaled up and diversified networks and systems. To attain this outcome, existing networks must be bolstered, and alternative systems should be explored to aid in de-risking communities' access to the services provided by these infrastructure systems.

Prioritizing adaptation strategies that ensure resilient and sufficient energy, transport, and communication infrastructure will not only ensure the security of the services stemming these

¹⁷⁸ Refer to Appendix 3 – Energy, Transport, and Communications to see list of policies and programs referenced as part of the NAP process



infrastructure systems, but also an improvement in the qualities of life across the country's population. Resiliency must be embedded across the whole planning, construction, and response processes of these infrastructure systems, while applying regional and hazard specific lenses to trends identified through climate analytics models to ensure the secure distribution and access across all subsectors.

Priority Adaptation Strategies for Energy, Transport, and Communications

Outcome 1: Comprehensive planning and response mechanisms established across energy, transport, and communication infrastructure.

Implementing Lead agencies:

DOE, DPWH, DOTr, DICT

Supporting agencies:

DOST, DENR, NCIP

Select Key Strategies	Brief Description	Implementation Priority	Capital-intensiveness
Upgrade engineering design codes for critical infrastructure	Updating engineering design codes and standards for critical infrastructure to account for climate change impacts	Immediate (0-3 years)	Medium
Regulate and enforce critical infrastructure standards based on land zoning and risk assessment	Implementing and improving building codes and land-use regulations such as the National Land Use Act and National Building Code, informed by thorough risk assessments, to ensure that vital infrastructure is strategically located and designed to withstand natural hazards	Immediate (0-3 years)	Medium
Incorporate climate risk into planning of roadways and transportation hubs	Strategic determination of efficient road routes and optimal locations for transportation hubs considering climate risks alongside regular factors	Immediate (0-3 years)	High
Integrate energy infrastructure planning and site selection	Ensure new energy infrastructure situated in best suited areas based in shifting climate patterns, building upon the Philippine Energy Resiliency Policy, and the National Energy Contingency Plan	Immediate (0-3 years)	Medium
Climate-proof critical infrastructure	Implementing green and grey flood/landslide protection measures, and wind-proofing elevated infrastructure transportation infrastructure, supporting initiatives such as the Asset Preservation	Medium-term (3-6 years)	High



	Program of DPWH, or the Energy Resiliency Policy of DOE		
Perform resilience planning across communication networks	Integrating redundant pathways, warm stand-by systems, and real-time monitoring of networks to ensure continuous and reliable connectivity, such as the 'Resiliency Route' for the National Broadband Programme	Medium-term (3-6 years)	High
Enforce response and maintenance measures	Ensure adherence to regular maintenance procedures, have emergency preparedness and response plans, as well as post-disaster assessment procedures across critical infrastructure	Medium-term (3-6 years)	Medium

Outcome 2: Sufficient capacity of energy, transport, and communication infrastructure services to meet evolving demand induced by climate change.

Implementing Lead agencies: DOE, DPWH, DOTr, DICT	Supporting agencies: DOST, DENR, NCIP

Select Key Strategies		Brief Description	Implementation Priority	Capital-intensiveness
ENERGY	Perform R&D to understand energy flow accounts	Referencing natural capital accounts, energy flow accounts can provide indicators on energy efficiency in terms of the flows of energy inputs to the economy, flows of energy inputs to the economy, flows of energy within the economy, and flows to the environment as residuals	Immediate (0-3 years)	Medium
	Install infrastructure to ensure	Energy storage systems, microgrid, natural	Immediate (0-3 years)	High



	continuous energy supply to remote and vulnerable areas	gas generators strategically distributed across vulnerable areas and communities, supporting the Energy Resiliency Policy and the National Energy Contingency Plan		
	Enforce policies to encourage alternative energy sources and energy efficiency	Enforcing alternative energy sources for suppliers, and energy efficiency regulations for consumers, leveraging items such as the Energy Efficiency and Conservation Act, as well as the Feed-in Tariff System which incentivizes investors and developers to put up renewable energy projects	Immediate (0-3 years)	High
	Encourage and facilitate investment in smart grids	Intelligent electrical grids allowing efficient energy distribution, real-time monitoring and response to climate-related disruptions	Medium-term (3-6 years)	High
	Improve infrastructure to enhance inclusivity of alternative transport systems	Implementing alternative transportation infrastructure improvement projects such as expanded and improved bike lane systems, pedestrian walkways, railway	Immediate (0-3 years)	High



TRANSPORT		systems, building on policies such as the Philippine Bicycle Act		
	Incentivize of new technologies and design innovations within public and private transport	Encouraging intelligent transportation systems, electronic vehicles, etc. to avoid overdependence on a single source, by strengthening initiatives such as the Republic Act (RA) 11697 or the Electric Vehicle Industry Development Act which seeks to develop the Philippine electric vehicle (EV) industry via mechanisms such as tax incentives	Medium-term (3-6 years)	High
	Invest in mass transport and transit-oriented development	Directing investments towards the improvement and expansion of mass transport networks and promoting transit-oriented development, expanding on existing programs such as KATUPARAN or the Kalsada Tungo sa Paliparan, Riles at Daungan Program	Medium-term (3-6 years)	High



COMMUNICATIONS	Augment communication infrastructure to strengthen digital connectivity	Expanding both conventional infrastructure (fixed broadband, fiber, mobile networks) as well as alternative sources of digital connectivity, such as broadband satellites to meet general demand while providing access to remote communities	Medium-term (3-6 years)	High



NAP Implementation

Chapter

05



5. NAP Implementation

Approach

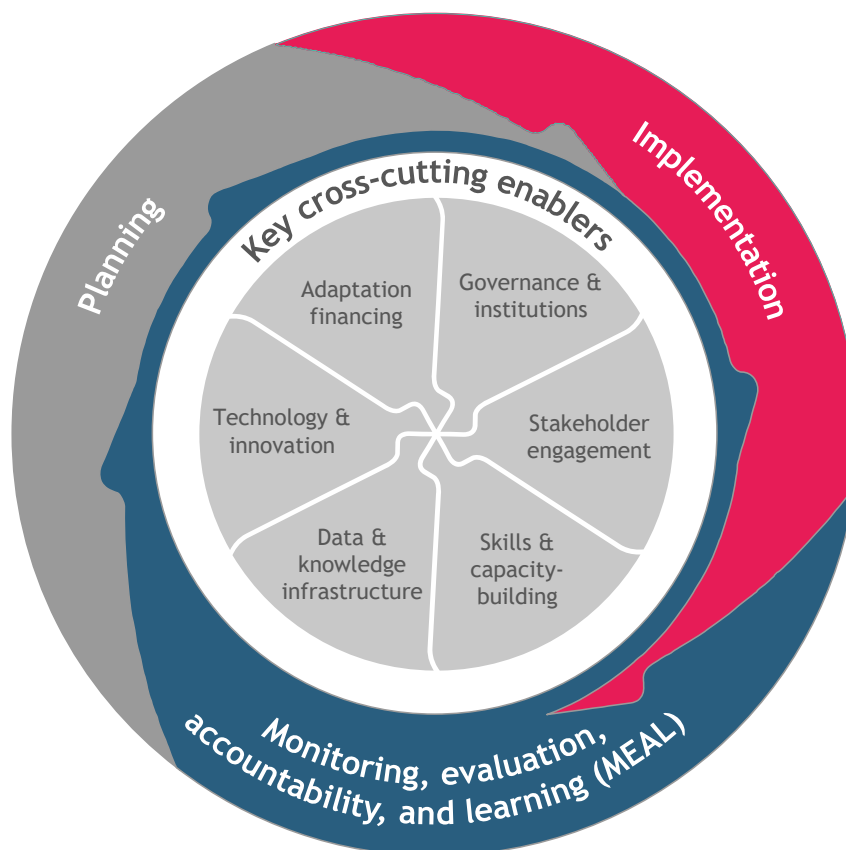


Figure 5.1.1. PH NAP implementation framework¹⁷⁹

The PH NAP implementation framework, as shown in Figure 5.1.1, is guided by international frameworks, guidelines, and adaptation platforms. These include the Cancun Adaptation Framework, UNFCCC guidelines, and NAP Global Network, and the Philippines' unique national circumstances, overall policy environment, and in-country process on adaptation planning, investment programming, implementation, and monitoring and evaluation.

¹⁷⁹ Based mainly on NAP process map from the NAP global network and key lessons synthesized from UNFCCC guidelines, Cancun Adaptation Framework, and the Philippines' national circumstances



The PH NAP implementation framework follows a dynamic cycle with three phases – planning, implementation, and monitoring evaluation, accountability, and learning - and is supported by key cross-cutting enablers, which have been adapted from the NAP Global Network and lessons learned from international NAPs and expert inputs. Importantly, they have been validated with key stakeholders in the Philippines to ensure its applicability.

The PH NAP implementation framework follows five key guiding principles:

1. Based on international guidelines and local priorities in the logical framework.
2. Embraces a whole-of-nation approach, fostering collaboration across government and non-government entities, including local communities and diverse demographic groups.
3. Integrates with existing plans, policies, strategies, and mechanisms to prevent redundancy and incorporates adaptation into ongoing initiatives
4. Undergoes regular evidence-based review, rooted in local context and informed by the latest scientific knowledge.
5. Prioritizes a fair transition and inclusivity.

This chapter of the NAP document focuses on three critical aspects: key cross-cutting enablers, implementation planning, and the MEAL system. It assesses the current state of key enablers, proposes enhancements, and outlines next steps. It presents a roadmap for adaptation and enabling action plans, including lead agencies and timelines. Finally, it offers an overview of developing a comprehensive NAP MEAL strategy, drawing from national and global frameworks.



5.1 Key cross-cutting enablers

Key cross-cutting enablers

The PH NAP implementation framework is supported by six key cross-cutting enablers:

1. Governance & Institutions
2. Stakeholder Engagement
3. Skills & Capacity-Building
4. Data & Knowledge Infrastructure
5. Technology & Innovation
6. Adaptation financing

These key enablers are crucial for effective planning, implementation, and monitoring evaluation, accountability and learning for the PH NAP. Each key enabler section covers the following topics:

1. **Definition and purpose** – A concise description and underscores the significance of each enabler within the context of the NAP.
2. **Key success factors** – The vision of the PH NAP for each enabler, drawing from international guidelines and exemplar practices.
3. **Starting point** – Summary of the current state in the Philippines, encompassing vital issues and areas with potential for improvement for each enabler.
4. **Action plan** – Outline of actions proposed to operationalize the NAP. It is important to acknowledge that these action plans are subject to potential iterations over time as key learnings & innovations are captured.

5.1.1 Enabler 1: Governance and institutions

Definition and Purpose

Definition:

Governance & institutions refer to strategic measures and arrangements to enable government-level coordination and adaptation integration into development processes.

Governance and institutions have a key role in driving effective coordination, collaboration, and implementation of the PH NAP across various government entities and stakeholders. Additionally, improved governance will underpin the country's collective effort to ensure long-term climate and disaster resilience and accelerate efforts to achieve the Philippines' long-term vision as stated in AmBisyon Natin 2040.

Key success factors



To fully operationalize the NAP, there are four key success factors under the governance and institutions enabler.

Key success factors:

1. Well-defined roles and responsibilities to strengthen sense of ownership, commitment, and advocacy to adaptation present across government entities, especially for leaders.
2. Shared clear vision and objectives among government entities.
3. Adaptation lens integrated across government roles, responsibilities, and operations.
4. Institutional arrangements marked by resilient horizontal and vertical coordination are firmly established, while local government units (LGUs) are seamlessly integrated, empowered, and actively engaged in every facet of the National Adaptation Plan (NAP) process.

Starting point

The Philippine government has consistently undertaken proactive measures to tackle climate change impacts at the national, local, and sectoral levels, as seen in Figure 5.1.1.1. This reflects a dedicated, country-wide approach encompassing both mitigation and adaptation efforts.

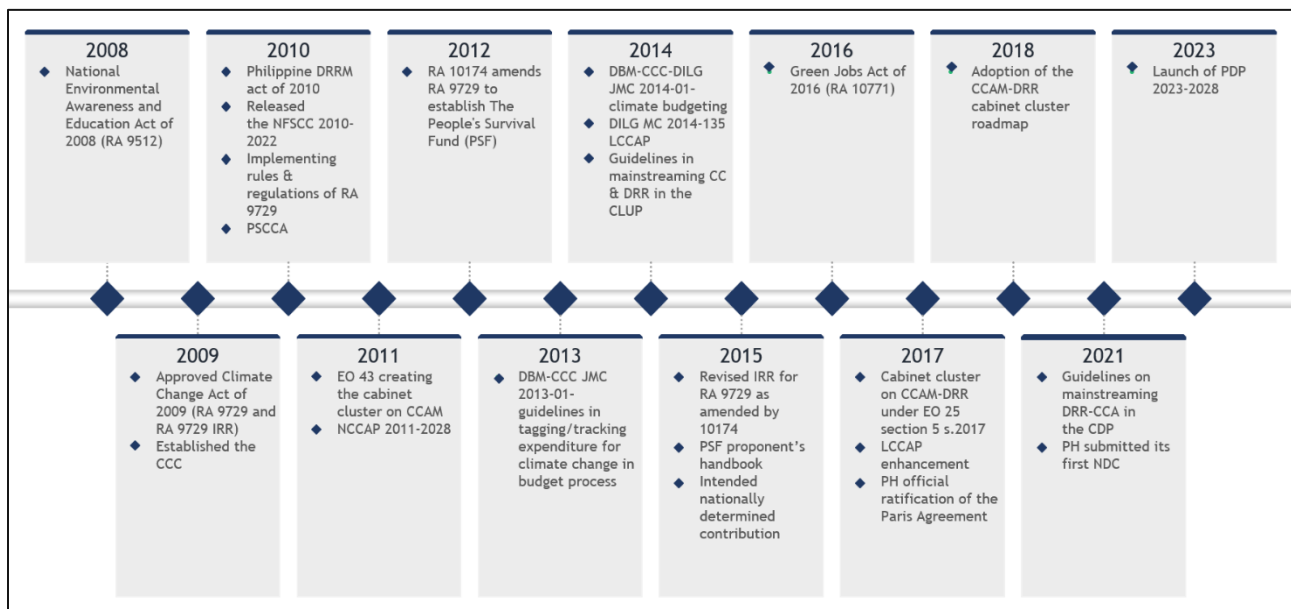




Figure 5.1.1.1 Timeline of select government activities related to climate change adaptation¹⁸⁰

Roles & responsibilities of government entities in climate change agenda today

Several government entities have a role to play in the NAP process (see table in Chapter 5 Appendix). The Climate Change Commission (CCC) takes the lead in coordinating, monitoring, and evaluating climate change-related activities. Executive departments and select national agencies are responsible for integrating adaptation within their respective disciplines. Local government units also play a crucial role by contributing localized knowledge and implementing adaptation actions. This interplay across & along government levels (i.e., horizontal, and vertical coordination) necessitates robust coordination mechanisms be put in place to operationalize the PH NAP, foster cross-learning, and realize synergies.

Relevant climate change-related policies, plans and strategy

Multiple climate change plans and strategies are currently in place (see table in Chapter 5 Appendix). However, the presence of overlapping policies, plans, and strategies necessitates an urgent assessment and streamlining process to avoid disputes and ensure efficient implementation of the NAP.

Current institutional arrangement of the NAP

To kickstart the NAP process, the Philippines has created the National Steering Committee for the National Adaptation Plan (NAP-NSC) under the leadership of the Climate Change Commission (CCC). However, to institutionalize the NAP process, the Philippines still need to define an optimal governance structure.

¹⁸⁰ RA – Republic Act, DRRM – Disaster Risk Reduction and Management, NFSCC – National Framework Strategy on Climate Change, CCAM – Climate Change Adaptation and Mitigation, DBM – Department of Budget and Management, CCC – Climate Change Commission, JMC – Joint Memorandum Circular, PSF – Peoples' survival fund, DILG – Department of Interior and Local Government, MC – Memorandum Circular, LCCAP – Local Climate Change Action Plan, CC – Climate Change, DRR – Disaster Risk Reduction, CLUP – Comprehensive Land Use Plan, EO-Executive Order, DRR-CCA – Disaster Risk Reduction & Climate Change Adaptation, PDP – Philippine Development Plan, CDP – Comprehensive Development Plan, NDC – Nationally Determined Contributions

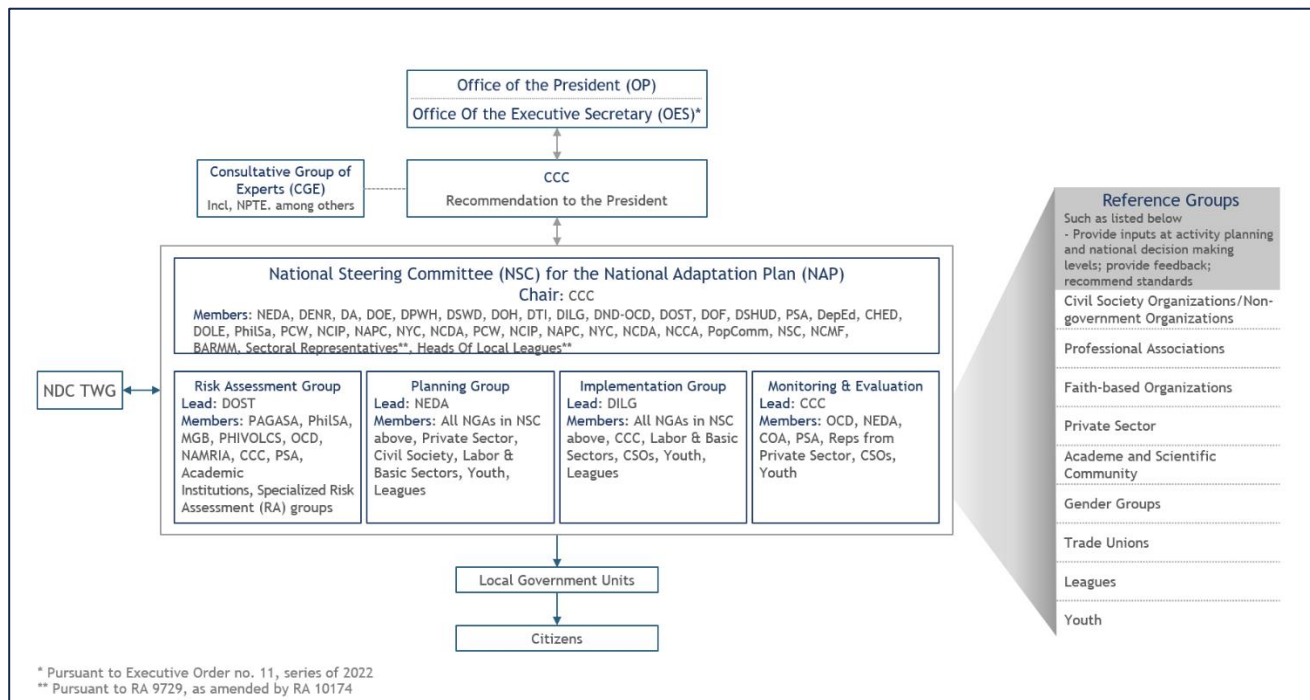


Figure 5.1.1.2 Current institutional arrangements on the Philippines' NAP

Action plan

To enable strong governance & institutions for adaptation, the government of the Philippines are committed to the actions listed in table 5.1.1.1.

Table 5.1.1.1 Governance & institutions long list of actions

No.	Overview of actions	Timeline ¹⁸¹
GI 1	Define national level governing structure and coordinating mechanism for NAP implementation that is integrated and aligned with existing adaptation mechanisms: Clearly define overall permanent governance mechanism to facilitate the NAP after NAP-NSC by: 1. Assigning a high-level entity (e.g., Cabinet Cluster on CCAM-DRR, CCAB) to provide policy advice and decision-making. 2. Assigning a technical working group for projects, investments, and technical matters.	Immediate (0-3 years)

¹⁸¹ Immediate – needs to be done earliest as possible to lay the foundation for other activities; medium-term – important activities unlocked / can be done after establishing foundational activities



	3. Assigning other key focal entities such as data office, finance focal point, sector-specific climate change adaptation focal points, representatives from vulnerable communities, etc. More clearly demarcate and detail roles and responsibilities of government units and institutions to avoid disputes and gaps (e.g., clear assignment of data and analytics roles and handoffs between CCC, DOST PAGASA, etc.) Establish coordination mechanisms to harmonize entities, foster synergies, prevent duplication, and strengthen cross-sectoral convergence in alignment with PDP 2023-2028 (e.g., establishing working sessions between DILG, DOST, and NEDA to translate plans into local implementation actions) Conduct thorough stocktaking of existing plans, policies, and strategies to align the NAP with ongoing efforts and decomplexify climate change efforts (e.g., establishing the linkages between the NAP and other frameworks and plans such as NFSCC and NCCAP)	
GI 2	Define horizontal (sectoral) and vertical (LGU) integration strategy: Strongly embed sectoral entities and LGUs, leagues, and regional development councils in permanent institutional arrangement to strengthen cross-sectoral convergence and enable adaptation localization, cross-LGU collaboration, and alignment of LGU priorities with national & sectoral priorities.	Immediate (0-3 years)
GI 3	Mainstream climate change adaptation into other policies and plans Integrate adaptation and resilience considerations into national planning and enact policy reforms that encompass provisions aligned with climate change adaptation and resilience. This entails of first undertaking a comprehensive assessment and streamlining of existing plans, policies, and strategies. (e.g., Integrate resilience measures into existing Green Building Code)	Medium term (3-6 years)
GI 5	Create comprehensive risk management approach: Develop and implement a comprehensive risk management approach to reduce intersecting vulnerabilities and address complexities in managing compounding and cascading risks posed by climate change across sectors as highlighted in PDP 2023-2028.	Medium-term (3-6 years)



GI 6	Develop NAP governance & institutions assessment tools to enhance adaptation enforcement: Develop appropriate assessment tools such as environmental valuation methodology to inform adaptation enforcement, decision-making, policy development, research & development, payment & incentive mechanisms, and other climate change-related endeavors. Additionally, establish a long-standing repository of climate-related goals and activities to ensure continuity amidst changing governance/leadership, including a method to hold units accountable despite leadership changes.	Medium-term (3-6 years)

Conclusion

In conclusion, governance and institutions are pivotal in enabling the NAP process by establishing ownership, collaboration mechanisms, and linkages with existing plans, policies, and strategies. To drive this process, the Philippines has established the NAP-NSC to streamline and operationalize the NAP; however, this is an interim version and will be revised immediately. To push a more streamlined climate change agenda, the Philippines will identify the best governance mechanism that involves one high-level entity (e.g., CCAM-DRR or CCAB) and a streamlined technical working group for climate change. By enhancing governance and institutions, the Philippines aims to seamlessly integrate adaptation into its national blueprint, ensuring resilience and a sustainable future.



5.1.2 Enabler 2: Stakeholder engagement

Definition and purpose

Definition:

Stakeholder engagement refers to socially inclusive efforts to engage key actors (local, national, and international communities) to operationalize the NAP process.

Stakeholder engagement plays a pivotal role in achieving climate equity among vulnerable groups, fostering collaboration, enabling cross-learning based on differing experiences & perspectives, and optimizing synergies among diverse autonomous groups in the Philippines, each with unique yet complementary strengths:

1. The private sector brings substantial industry experience, a network of national and international partners, and development financial institutions that could leverage adaptation finance and investments.
2. Academia and research institutions provide technical expertise, technical assistance, technological innovations, and knowledge on best available science.
3. Local community organizations possess in-depth localized understanding and established relationships, working alongside community members who offer vital first-hand insights.
4. International community brings in expertise, external opportunities, and a wealth of other key learnings.
5. Vulnerable groups, including persons with disabilities, indigenous communities, MSMEs, and youth, provide essential perspectives and solutions for equitable adaptation outcomes, recognizing the importance of multi-generational engagement, particularly with youth, to foster awareness, advocacy, and understanding in climate change adaptation.
6. Gender-focused organizations and advocates that work specifically on gender-related aspects of adaptation.
7. Experts / practitioners from varying disciplinary studies enable the development of novel & inter-disciplinary approach to tackling adaptation.

By fostering knowledge transfer and collaboration among these entities, the Philippines can enable collective action, co-learning, co-development of solutions, and capabilities sharing to effectively advance the NAP agenda at national and local levels. Additionally, collaboration enables a whole-of-the-nation approach while also considering a tailored adaptation approach across widely differing local community contexts (e.g., varying climate risks, capabilities, and resources available in each community).



Key success factors

To fully unlock the value of stakeholder engagement, three key success factors must be met as shown in the table above. These key success factors reflect the end state targeted by the PH NAP.

Key success factors:

1. Embraces inclusivity, collaboration, transparency, and participation across government and non-government entities, guided by a whole-of-the-nation and whole-of-the-planet approach while aligning with locally led adaptation.
2. Special attention directed towards highly vulnerable groups to guarantee equitable adaptation outcomes and capture diverse & valuable adaptations insights & solutions.
3. Established roles, responsibilities, and engagement mechanisms for non-government stakeholders, tailored communication based on stakeholder needs, and a focus on meaningful engagement to ensure high-quality participation and effective outcomes.

Starting point

Currently, there is a need for enhanced coordination and stakeholder engagement in the implementation of existing plans, policies, and strategies in the Philippines. The voluntary and non-incentivized nature of involvement may result in limited quality of participation of vulnerable groups and communities (e.g., existing policies such as RA 10174 only encourages rather than mandate or incentivize community participation). It is also important to highlight that many vulnerable groups and communities lack sufficient capacity and awareness regarding available spaces and platforms for participation. To overcome these challenges, the government of the Philippines will begin by identifying key stakeholders, bridging engagement gaps, providing necessary tools and programs, raising awareness, incentivizing participation, and establishing clear engagement mechanisms throughout the entire NAP process.

Efforts have already been made by the government of the Philippines to ensure stakeholder participation. For instance, under RA 10174, the Climate Change Commission (CCC) is mandated to consult and coordinate with relevant sectors. Furthermore, the creation of the Participatory Governance Cluster (PGC) through Executive Order number 24 (EO 24) facilitates inter-agency collaboration and enhances citizen participation in government activities. Additionally, gender mainstreaming will be done through the existing Gender Equality and Women Empowerment Plan and the Gender and Development (GAD) agenda.

Most recently, the CCC has developed various programs, including the ACCELERATE, ENACT, WE CAN, CONNECT, and ACT LOCAL programs, to further bolster stakeholder engagement (see table in Chapter 5 Appendix for summary of programs).



Action plan

To operationalize effective stakeholder engagements for adaptation, the government of the Philippines are committed to the actions listed in table 5.1.2.1.

Table 5.1.2.1 Stakeholder engagement list of actions

No.	Overview of actions	Timeline ¹⁸²
SE 1	Identify engagement gaps & opportunities to boost involvement of key stakeholder groups: 1. Identify who are the key stakeholder groups, particularly different demographic groups needing engagement. 2. Identify pain points and needs of each stakeholder group. 3. Perform a thorough assessment of the current stakeholder roles, responsibilities, contributions, level of participation in adaptation activities, ongoing engagement mechanisms, and coordination mechanisms to pinpoint and rectify significant gaps in stakeholder involvement and collaboration. (e.g., identifying gaps and strategizing involvement of academia, private sector, persons with disabilities, indigenous groups, gender groups, vulnerable local communities, etc. in implementing and reviewing the NAP)	Immediate (0-3 years)
SE 2	Develop inclusive and collaborative engagement strategy tailored for sectoral and local entities to build awareness of the NAP: 1. Develop a simplified and abbreviated version of the NAP to summarize key insights relevant for sectoral and local entities. 2. Strategize to create or enhance existing plans, establishing inclusive arrangements and coordination mechanisms that encompass outreach, input collection, co-development, and co-implementation of adaptation solutions alongside different stakeholders. 3. Experiment and deploy various communication techniques (e.g., culture-based communications, use of artistic methods to engage, in-person visits etc.) tailored to engage specific stakeholder groups. (e.g., organizing regular forums with vulnerable groups representatives, with groups from other disciplines such as the arts)	Immediate (0-3 years)

¹⁸² Immediate – needs to be done earliest as possible to lay the foundation for other activities; medium-term – important activities unlocked / can be done after establishing foundational activities



SE 3	Build multi-stakeholder engagement platforms: Utilize the CIN as a foundation to construct multi-stakeholder platforms & channels that improve communication and transparency among stakeholders. This includes having an effective mechanism for engaging local communities and indigenous people and gathering their input. (e.g., scaling CONNECT, ACCELERATE, ENACT, & WE CAN programs)	Medium-term (3-6 years)
SE 4	Develop long-term network strengthening strategy: Develop longer-term plan to sustain and enrich engagements with and across each stakeholder group, enabling continuous involvement and cross-sharing. This includes strategic public-private partnerships with local and international players.	Medium-term (3-6 years)

Conclusion

In conclusion, diverse stakeholder engagement and representation are essential for a comprehensive whole-of-the-nation approach to the NAP in the Philippines. Vulnerable groups possess valuable knowledge and experience. While the government has initiated mechanisms, gaps remain in reaching remote, indigenous, and highly vulnerable communities. To address this, a detailed assessment of stakeholder engagement gaps will be conducted, followed by establishing initial interim arrangements. As the NAP progresses, these arrangements will be enhanced for seamless and regular participation, co-learning, and co-development among stakeholders.



5.1.3 Enabler 3: Skills & capacity building

Definition and purpose

Definition:

Skills & capacity building refers to investments equipping entities with the necessary capabilities to operationalize the NAP effectively and efficiently.

Skills and capacity building plays a pivotal role in facilitating the PH NAP process. By providing essential knowledge, tools, and a network, it empowers key stakeholders to actively contribute toward achieving the nation's adaptation objectives. This includes imparting data management and analytics skills to local government units, conducting adaptation and climate change awareness programs for highly vulnerable communities, and bolstering technical capacities within Higher Education Institutions (HEIs).

Furthermore, this approach cultivates collaboration among stakeholders with diverse yet complementary skill sets. For example, HEIs, equipped with robust technical expertise, are guiding local government units and vulnerable communities in comprehending climate change science, and implementing effective adaptation strategies. Given that stakeholders vary in their capabilities and needs, a crucial aspect of this approach is to accurately identify key gaps and surpluses in capabilities and capacities across stakeholders. Building a strong partnership network is vital for facilitating the transfer of capabilities.

Key success factors

To fully enable key stakeholders to participate in the PH NAP process, five key success factors will be taken into consideration as shown in the table below.

Key success factors:

1. Comprehensive evaluation and ongoing monitoring of capacity gaps among NAP key stakeholders in place.
2. Inclusive and comprehensive capacity-building programs that leverage technical assistance and strategies customized to each key stakeholder.
3. Sufficient human, institutional, financial, and organizational capacities available to facilitate capacity-building programs among PH NAP key stakeholders.
4. Key insights, best practices, best available science, new innovations, and localized discoveries captured and shared among PH NAP stakeholders.
5. Robust partnerships network in place to facilitate capabilities transfer.

Starting point



Taking the lead in developing adequate skills & capacity building mechanisms, the CCC has established some programs, tools, guidelines to equip key stakeholders responsible for executing each step of the PH NAP.

Among these programs is the Communities for Resilience (CORE program) established back in 2016. The CORE program aims to strengthen planning and programming capacity of LGUs to kickstart their adaptation activities; strengthen the technical capacities of Higher Education Institutions (HEIs) to mentor and enhance the knowledge of LGUs, vulnerable groups, and indigenous people on the science, issues, vulnerabilities, and risks of climate change; and develop a pool of local technical experts with strong know-how on nationally developed tools, guidelines, and strategies such as the development of Local Climate Change Action Plan (LCCAP), Climate & Disaster Risk Assessment (CDRA), Climate Change Expenditure Tracking (CCET), and People's Survival Fund (PSF) project proposals.

Despite the existence of initiatives needed to upskill relevant stakeholders, these initiatives are mostly in the pilot stage, thus the Philippines will not only push for more innovative capacity building mechanisms but also focus on scaling proven and tested programs beyond pilot scale. Additionally, these programs developed focus more on building technical capacity rather than highlighting the importance and impact of climate change through climate science. As a result, select LGUs have low appreciation and sense of urgency to address climate-induced risks.

Beyond these programs by the CCC, the entire government has taken actions to upskill the younger population. Through the RA 9512, Department of Education (DepEd) integrated environment in school curriculum while DOST ensures students receive science-based quality information to inspire development of environment-friendly solutions. Also, through the RA 9512, DepEd together with the Technical Education and Skills Development Authority (TESDA), Commission on Higher Education (CHED) in coordination with DENR will undertake capacity-building programs on environmental education nationwide.

Action plan

To enhance skills and capacity building for adaptation, the government of the Philippines are committed to the actions listed in table 5.1.3.1.

Table 5.1.3.1 Skills & capacity building list of actions

No.	Overview of actions	Timeline ¹⁸³
SCB 1	Identify knowledge, skill, and capacity gaps in relation to climate change adaptation across national and local entities: Clearly map and assess skills, capacity, and infrastructural gaps and strengths across key stakeholders in the NAP process.	Immediate (0-3 years)

¹⁸³ Immediate – needs to be done earliest as possible to lay the foundation for other activities; medium-term – important activities unlocked / can be done after establishing foundational activities



	(e.g., gap in LGU skills on creating proposals to acquire adaptation funding, vulnerable groups lack awareness on adaptation measures, LGUs have limited technical capacity and infrastructure to utilize risk information)	
SCB 2	Strengthen technical and institutional capacity of agencies across specialized adaptation topics tailored to address key issues and needs: Create and implement adaptation awareness and foundational training initiatives, utilizing diverse delivery methods tailored to distinct stakeholder groups, with a specific focus on vulnerable communities and pivotal decision-makers. Successful pilot programs will be scaled to reach a wider audience, taking advantage of the Philippines' abundant manpower. (e.g. data generation and collection, adaptation 101 tailored for inherent risks in coastal, landslide-prone, flood-prone, and remote communities) Develop technical assistance programs in collaboration with technical experts of topic Provide tools and build the capacity of key stakeholders, particularly government entities, to access, analyze, and interpret climate data, facilitating the formulation, implementation, and monitoring of relevant policies and programs as outlined in PDP 2023-2028.	Immediate (0-3 years)
SCB 3	Identify & promote adaptation champions: Establish and promote government and non-government champions to lead and advocate for adaptation initiatives. (e.g., identify and define local government office responsible to implement NAP initiatives)	Immediate (0-3 years)
SCB 4	Integrate adaptation to national education curricula: The Philippines will build on NCCAP activity to integrate climate change in basic and higher education curricula, particularly focusing on the importance of climate change adaptation, resilience, loss and damage, and disaster risk reduction.	Medium-term (3-6 years)
SCB 5	Promote partnerships with academe to deliver capacity-building programs:	Medium-term



	Harness the capabilities of other sectors to amplify the delivery of capacity-building programs, for example, by integrating skills and capacity-building initiatives with academic and training institutions to achieve broader reach and impact. (e.g., trained HEIs to teach vulnerable communities on the importance of adaptation)	(3-6 years)
SCB 6	Create adaptation best practices playbook and collaborative learning platforms with varying communication methods to share key climate-related information: Initiate plan to create an adaptation best practices playbook including both indigenous knowledge, systems, and practices, and science-based approaches (e.g., building on the long list of adaptation solutions per sector identified in this NAP) Establish a collaborative platform facilitating sustainable knowledge-sharing among diverse entities for mutual learning and growth. Create a communications strategy for the capacity-building programs, designed to effectively share essential climate science and adaptation knowledge among diverse stakeholder groups with varying communication preferences.	Medium-term (3-6 years)

Conclusion

Skills & capacity building empower stakeholders to actively engage and collaborate in implementing the PH NAP. While the Philippine government has made initial efforts to enhance stakeholder capabilities, scaling these initiatives to a wider population is necessary to scale adaptation action. Going forward, the Philippines will focus on developing and expanding skills & capacity building mechanisms, while also identifying complementary skills and capacities among stakeholders to foster collaboration and co-development. To kick-start this process, a comprehensive mapping of skills and capacities across stakeholders will be conducted, followed by the development of a NAP curriculum that recognizes and leverages the complementary nature of stakeholder skills and capacities.



5.1.4 Enabler 4: Data & knowledge infrastructure

Definition and purpose

Definition:

Data & knowledge (information) infrastructure refers to the generation, management, and use of climate change-related information to operationalize the NAP process.

Information plays a critical role in enabling the NAP process by providing a solid foundation grounded in science and evidence, thereby strengthening decision-making among key stakeholders. It facilitates a comprehensive understanding of exposure and vulnerability to climate hazards, enabling the prioritization of impactful and easily implementable programs through cost-benefit analyses and impact evaluation against baseline values. Historical data analysis and scenario generation support decision-makers in taking proactive measures despite the uncertainties of climate change. Furthermore, information serves as a catalyst for creating a compelling narrative that mobilizes critical NAP actors both locally and internationally, fostering a unified call to action.

Key success factors

To unlock the full potential of information, four key factors, as shown in table above, will be taken into consideration.

Key success factors:

1. Climate change information is easily accessible and stored in a format that all, interoperable, communicated in a tailored manner to meet stakeholder needs.
2. Usable analytical models for adaptation across entities, generating actionable insights and data-driven approaches from information.
3. Ownership of climate change information is well-defined, encompassing responsibilities throughout its lifecycle.
4. Mechanisms are in place to capture real-time learnings and new information through feedback channels.



Starting point

Currently, the Philippines possesses a wealth of climate-related data and knowledge. However, these resources are managed and stored independently by various sources, resulting in additional effort to access, clean, and utilize the information. While the government created the National Mapping and Resource Information Authority (NAMRIA) to kickstart efforts on centralizing data sourcing, its application for climate change-related information gathering is still nascent. This lack of harmonization in data and knowledge creates challenges in gathering, cleaning, and processing information for end-users.

Notably, organizations such as DOST PAGASA excel in data collection and insight generation through sophisticated analytical models and tools like HazardHunter. However, other entities lack equivalent capabilities to process available information and generate pertinent insights.

Currently, CCC created the National Integrated Climate Change Database Information and Exchange System (NICCDIES) to serve as the integrated information portal of the CCC. However, NICCDIES does not operate alone as other relevant government agencies facilitate information sharing. This presents an opportunity to streamline climate change-related information to a single repository as a main source of truth.

Recently, DOST initiated PlanSmart, a comprehensive tool integrating existing platforms like HazardHunter and GeoRiskPH into a unified government entity platform. PlanSmart, specifically GeoRisk, acts as central data lake for climate-related data and information. The tool's goal is to present LGUs with projected climate hazards, enable the ability to add historical hazards and their impact over time, and formulate a standardized adaptation plan. However, certain prerequisites such as robust data architecture, ownership, security, user experience and interface design, incorporation of tools from other departments, and monitoring plan must be addressed to ensure platform comprehensiveness, quality, usability, and continuous usage.

Key actions

To strengthen data and knowledge infrastructure for adaptation, the government of the Philippines are committed to the actions listed in table 5.1.4.1.

Table 5.1.4.1 Data & knowledge infrastructure specific actions

No.	Overview of actions	Timeline ¹⁸⁴
DKI 1	Establish well-defined and user-friendly protocols for the collection of climate information: Harmonize, standardize, and simplify information generation and collection to maintain consistency. (e.g., building a central information collection platform where inputs from multiple entities are standardized)	Immediate (0-3 years)

¹⁸⁴ Immediate – needs to be done earliest as possible to lay the foundation for other activities; medium-term – important activities unlocked / can be done after establishing foundational activities



	Establish clear ownership of different climate change information. (e.g., Agreements to leverage climate-related data owned by private sector acknowledging data privacy laws and other relevant considerations, designate responsibility to LGUs for encoding and uploading localized climate change-related information)	
DKI 2	Stock-take and encode existing climate data in data lake Conduct detailed stocktaking, encoding, and standardizing of available climate-related information through centrally managed and accessible platform. (e.g., data from existing reports and databases to be encoded in an interoperable format then stored on central cloud-based platform) Improve and scale climate information platform, creating a comprehensive and centralized climate information bank for data. (e.g., CCC and relevant agencies can build on NICCDIES or Plansmart as central climate change information sharing platform) <i>* Similar to initiative AF 2 in Enabler 6 (Adaptation Financing)</i>	Immediate (0-3 years)
DKI 3	Institutionalize national adaptation data office: Build or designate an accessible adaptation data office to centrally manage adaptation data & knowledge, building upon existing systems of data collection and information from local and indigenous communities. (e.g., developing adaptation data offices in most vulnerable communities – “hotspots”, or build on PDP plan to establish local climate change data centers and natural hazard information centers, or build on DOST’s PlanSmart) <i>* Similar to initiative AF 4 in Enabler 6 (Adaptation Financing)</i>	Medium-term (3-6 years)
DKI 4	Enhance data security across platforms Implement robust data security measures across various tools and platforms to safeguard sensitive information, fostering trust and reliability in data management processes.	Medium-term (3-6 years)



	Establish environments to enable the testing of new features, ensure data quality assurance, and maintain isolation when uploading data from various departments. Implement Identity and Access Management (IAM) systems, along with associated roles and responsibilities, to effectively record and authenticate user login information, maintain access history for audits, monitor user activities, and enforce access policies.	
DKI 5	Integrate feedback mechanisms: Develop real-time and accurate feedback mechanisms in tools being developed. (e.g., integrate real-time feedback collection mechanism in NICCDIES platform)	Medium-term (3-6 years)
DKI 6	Develop national risk registry: Build on PDP 2023-2028 goal to develop a national risk registry that outlines and identifies location-specific hazards, exposure, and vulnerability, complementary to the development of localized climate models and projections and with a dedicated focus to progress beyond initial output-level data by providing richer insights for enhanced decision-making.	Medium-term (3-6 years)

Conclusion

In conclusion, the Philippines has an abundant pool of climate change information; however, this information are fragmented, unharmonized, and difficult to access today. To streamline information management, processing, sharing, and updating, the Philippines will build on existing tools and platforms and will build adaptation data offices. Building this upfront will enable a data and evidence-driven NAP process nationally and locally.



5.1.5 Enabler 5: Technology & innovation

Definition and purpose

Definition:

Technology & innovation refers to the development and/or transfer of solutions (both soft and hard solutions) enabling adaptation to the diverse impacts of climate change.

Advancing technology and innovation is crucial for economic growth, social progress, and addressing climate change impacts. This includes developing tools, policies, and solutions for adaptation. To be effective, adaptation tech and innovation must be tailored to the unique circumstances in various Philippine regions.

Key success factors

To enhance the PH NAP and bolster adaptation through innovation, five key success factors are considered, as shown in the table above. This aligns with the Philippines' goal to boost R&D and commercialization of new technologies, promoting research for improved adaptation tech.

Key success factors:

1. Adequate funding and incentives established to support the exploration, nurturing, and expansion of novel adaptation technologies.
2. A perpetual cycle of learning and innovation, coupled with a culture of adaptation-focused technology and innovation, deeply ingrained in the national framework.
3. Open and collaborative mechanisms instituted to facilitate mutual learning and joint innovation endeavors.
4. Customized and accessible development of technology and innovation, catering specifically to the needs of the most marginalized.
5. Operationalizing both national and international technology and innovation transfer mechanisms while establishing avenues to capture, share, and scale best available science, indigenous knowledge, and local experiences

Starting point

Advancing research, development, technology, and innovation is a top priority for the Philippines, as outlined in the PDP 2023-2028. This plan aims to accelerate R&D and technology progression while



strengthening innovation ecosystems. The Philippines also recognizes the importance of adaptation technologies within the National Adaptation Plan (NAP).

Research and development (R&D) in climate change adaptation (CCA) and disaster risk reduction (DRR) have been priorities in the Philippines' Harmonized National R&D Agenda (HNRDA) 2017-2022, guided by the Department of Science and Technology (DOST). Key research areas identified include advanced observation and monitoring systems, modeling for better forecasting, climate change adaptation tools, disaster risk management technologies, and policy development.

In addition to existing plans, the Philippines has initiated various programs to promote adaptation technology and innovation. The Climate Change Commission (CCC) launched programs like Klimathon to spur environmental solution development. RA 9512 mandates the DOST to offer science-based environmental education, inspiring eco-friendly innovations. Recently, the Philippines also approved the National Innovation Agenda and Strategy Document (NIASD) 2023-2032, aiming to enhance innovation governance and foster a dynamic innovation ecosystem.

Expanding on these initiatives, the Philippines will work to boost adaptation R&D, technology, and innovation. This effort includes promoting local tech development and adopting international advancements for local application.

Key actions

To increase technology and innovation for adaptation, the government of the Philippines are committed to the actions listed in table 5.1.5.1.

Table 5.1.5.1 Technology & innovation list of actions

No.	Overview of actions	Timeline ¹⁸⁵
TI 1	Reform policies to facilitate adaptation-related R&D/innovation and guardrails to protect vulnerable communities from undesired consequences of adaptation solutions Enhance policy frameworks to facilitate innovation and investment in adaptation, particularly in emerging domains (e.g. strengthening IP rights of adaptation-related R&D, offering incentives to encourage private sector investment in adaptation research and development) Establish proactive safeguards to ensure that adaptation solutions yield greater benefits than harm for vulnerable communities.	Immediate (0-3 years)

¹⁸⁵ Immediate – needs to be done earliest as possible to lay the foundation for other activities; medium-term – important activities unlocked / can be done after establishing foundational activities



TI 2	Promote adaptation-focused R&D in collaboration with non-state entities: In collaboration with key non-state entities (e.g. academia, the private sector, civil society, NGOs, etc.), incentivize, promote, and advance the pursuit for adaptation-focused R&D to build technical expertise. (e.g., promoting and scaling reach of DOST's Engineering Research for Development & Technology to fund more adaptation studies) Transform adaptation R&D concepts into viable projects through private sector funding. (e.g., scale Klimathon by CCC to accommodate more research institutes and include more representatives from the private sector, active participation in international adaptation-related accelerator programs)	Immediate (0-3 years)
TI 3	Build inclusive climate technology & innovation partnerships: Promote and support local and international technology & innovation partnerships to develop fit-for-purpose adaptation solutions and to acquire necessary funding. (e.g., participating in international scientific / technical conferences to learn from other researchers and foster international partnerships in developing new solutions; scaling the National Research and Development Conference to facilitate co-developments in the R&D sector) Promote an inclusive and participatory technology and information sharing and partnership mechanism to ground innovation with best available science and indigenous and local knowledge. Particularly, involve representatives from different demographic groups such as gender, age (youth and elderly), income levels, and indigenous peoples to unlock nuanced insights and solutions. Develop mechanisms and pathways to foster multi-stakeholder discussions and partnerships. (e.g., creation of platform connecting R&D sector to private sectors, climate-related innovators and investors, financial institutions, and international partners)	Medium-term (3-6 years)



TI 4	Deploy information collection & sharing mechanisms: Develop mechanisms to capture, share, and scale key insights, best available science, new innovations, indigenous knowledge, and local experiences, operationalizing both national and international technology and innovation transfer mechanisms.	Medium-term (3-6 years)
TI 8	Deploy local grants to pursue adaptation ideas: Create or scale existing local grants to incubate local adaptation ideas.	Medium-term (3-6 years)

Conclusion

In summary, the Philippines is intensifying efforts to develop adaptation solutions to address climate change impacts. There is growing enthusiasm to prioritize R&D, with small-scale initiatives in progress. The NAP will prioritize adaptation in R&D and support project transformation for private sector investment. It will also foster collaboration within the scientific community through active engagement in conferences and events.



5.1.6 Enabler 6: Adaptation financing

Definition and purpose

Definition:

Adaptation financing involves deploying strategies to secure, allocate, access, and optimize the use of financial resources for addressing climate impacts.

Globally and particularly in highly climate-vulnerable nations like the Philippines, there's a growing need for adaptation financing. As a developing country disproportionately affected by climate change, the Philippines must utilize domestic public, international development, and private sector funds to implement adaptation solutions and sustain the NAP process.

The central focus of this enabler in the NAP is to address issues and opportunities in allocating, accessing, and utilizing each funding source. As the NAP proceeds, a national investment and financing plan will be created to quantify the funding gap and optimize allocation to priority adaptation solutions.

Key success factors

To unlock a holistic and sustainable adaptation financing strategy for the Philippines, six key success factors will be critical.

Key success factors:

1. Utilizing a co-benefit approach: To enhance the mobilization of adaptation financing, policymakers can design priority programs and projects in a manner that not only addresses adaptation but also yields co-benefits in terms of advancing climate change mitigation, achieving the Sustainable Development Goals, COVID-19 recovery, and more.
2. Mainstreaming adaptation in Public Finance Management and budgeting: Integrate climate adaptation considerations into budgeting and financial planning processes to ensure adequate and timely public funding is directed towards high-impact adaptation interventions.
3. Enabling private sector investments in adaptation: Facilitate private sector investments in adaptation projects by highlighting potential risks, returns and benefits.



4. Leveraging innovative funding instruments: Explore a range of innovative funding instruments, especially those that help unlock private capital, by making semi-bankable projects viable.
5. Actively engage public sector and local communities throughout the process: Involve government agencies (national, sectoral, and local), local communities, and vulnerable groups in the formulation of adaptation financing strategies and prioritization.
6. Establishing robust and strategic networks: Partner with multiple Multilateral Development Banks (MDBs) and Development Finance Institutions (DFIs) to access additional funding, global project insights, technical support, and innovative funding mechanisms.

Starting Point

Three primary funding sources underpin the adaptation financing in the Philippines: (1) domestic public funding, (2) international development funding, and (3) private funding. Given the large funding gap for adaptation, the strategic targeting and utilization of each source or the combination of these sources is pivotal in ensuring sustainable funding for the nation's adaptation priorities.

While the Philippines urgently requires substantial funding from both the private sector and international sources, the country must exercise caution to ensure that the terms of such agreements align with its national interests, especially the well-being of the most vulnerable communities. Ill-considered terms could result in excessive costs, potentially obstructing the attainment of both national and local development objectives.

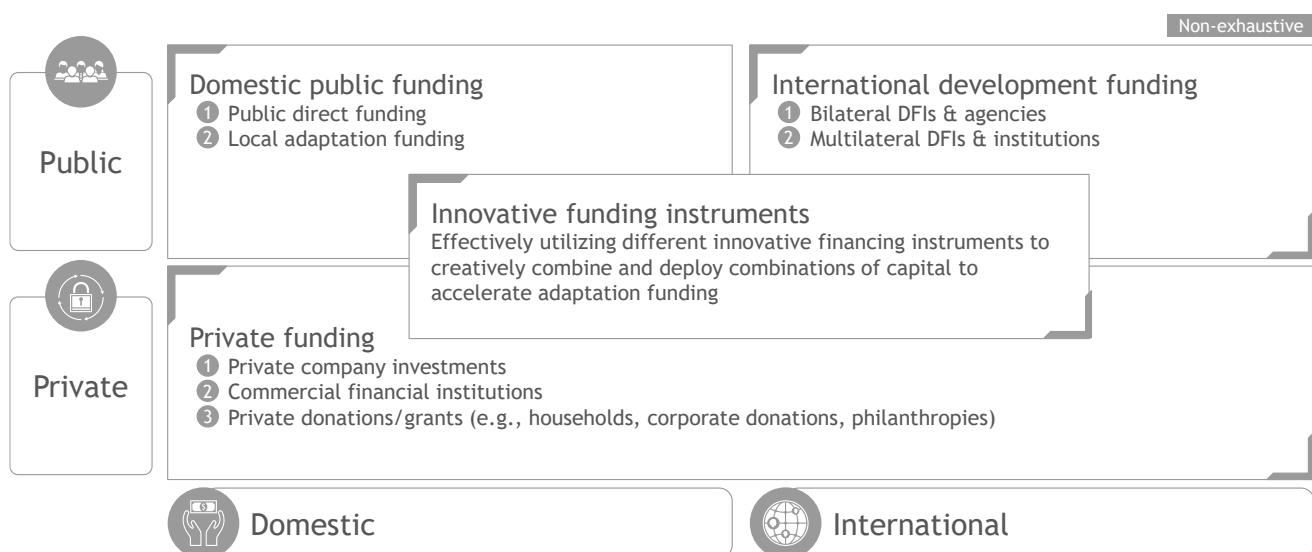


Figure 5.1.6.1 Adaptation funding sources in the Philippines

Domestic public funding



Domestic public funding refers to government funding allocated for adaptation. As a government-issued resource, domestic public funding not only sustains the NAP but also reflects the country's unwavering dedication to its adaptation commitments. It serves as a tangible demonstration of the Philippines' determination to protect its communities and ecosystems from the impacts of climate change.

Public direct funding

From 2016 to 2022, the Philippines allocated PHP 1.59 trillion for climate initiatives, representing 5.8% of total national spending during this period. Notably, 94.5% of this budget was dedicated to adaptation, highlighting the nation's commitment to A&R. In 2021, the Philippines allocated over PHP 275 Mn to adaptation, which increased to PHP 411 Mn in 2023, marking a 50% increase in two years.

Despite increased public climate funding, significant adaptation financing challenges persist. In the 2022 climate budget proposal, nearly 90% of the budget was allocated to four departments: DPWH (64%), DOTR (14%), DA (8%), and DENR (4%). This highlights the limited focus of current adaptation strategies, despite substantial public budget allocation. A closer look at DPWH reveals that most funding is directed toward flood management, indicating the need for broader infrastructure coverage to address other climate risks, such as typhoon-induced extreme winds. Specific sectors, like agriculture and transportation, show strong innovation in budget allocations.

Peoples' Survival Fund (PSF)

Recognizing the importance of localized adaptation, the Climate Change Act of 2009 was amended, leading to the establishment of the Peoples' Survival Fund (PSF) in 2012. This national treasury fund complements annual appropriations for relevant government agencies, enhancing climate change adaptation programs at the local level. The PSF serves as a long-term finance facility for adaptation projects proposed by LGUs and local/community organizations, with a minimum annual allocation of PHP 1 billion. This enables LGUs and accredited organizations to execute vital adaptation activities aligned with the National Framework Strategy on Climate Change (NFSCC).

However, the current approved PSF support is PHP 320.3 million, with ongoing reviews of project proposals. Presently, the PSF is funding only six projects located in Agusan del Norte, Cebu, Sarangani, Surigao del Sur, Surigao del Norte, and Tarlac, as part of the General Appropriation Act (GAA). The limited utilization of the PSF by LGUs and local communities is mainly due to challenges in accessing available funds and effectively utilizing them, including limited awareness of available financing facilities, insufficient integration of adaptation considerations, and funding disbursement challenges.

Programs Convergence Budgeting – Risk Resiliency and Sustainability Program (PCB-RRSP)

The Department of Budget and Management (DBM) initiated Programs Convergence Budgeting (PCB) to enhance strategic budgeting, interagency collaboration, and climate priorities. Under PCB, DENR and the CCAM-DRR cabinet cluster developed the risk resiliency and sustainability program (RRSP). This framework program aims to bolster natural ecosystems and vulnerable communities' adaptive capacity against short- and long-term risks. The NEP 2023 allocates PHP 307 Bn to PCB-RRSP. It encourages sub-projects in various LGUs and serves as a demonstration model to stimulate broader participation. Additionally, it enhances national agency programs through partnerships with LGUs and stakeholders.



However, program expansion has been gradual, with only 14 out of 82 provinces covered by 2021. These provinces include Masbate, Sorsogon, Negros Oriental, Western Samar, Southern Leyte, Eastern Samar, Zamboanga Del Norte, Bukidnon, Saranggani, Sultan Kudarat, North Cotabato, Surigao Del Norte, Surigao del Sur, and Dinagat Islands

International development funding

International development funding sources is defined as financial resources procured from public entities and global origins, earmarked specifically to bolster adaptation efforts. To meet the escalating adaptation demands of developing nations, particularly those most susceptible to climate change, developed countries have pledged an annual sum of \$100 billion to support both mitigation and adaptation endeavors in developing countries.

In addressing the Philippines' pressing adaptation financing requirements, supplementing domestic public funding with international development sources becomes imperative. Presently, the Philippines secures additional funding for climate finance through bilateral partnerships and multilateral sources, including the Global Environment Facility (GEF), Special Climate Change Fund (SCCF), Green Climate Fund (GCF), and Strategic Climate Fund, among others.

According to an ICSC study from 2013 to 2017, the Philippines received a total commitment of USD 4.3 billion from international climate funding, mainly from Japan and the World Bank, contributing 49% and 25%, respectively. During this period, 56% of the funding supported emissions reduction, while 44% went to climate change adaptation, with around 93% provided as loans.

In 2021, the Philippines' Official Development Assistance (ODA) Portfolio Review Report highlighted approximately 37 projects related to climate adaptation and mitigation, with 30% incorporating adaptation components. The report emphasized the importance of rebalancing the loans-to-grants ratio due to the country's debt situation. The prior year's NEDA ODA report estimated that these projects would cost PHP 128.8 billion, with the majority (96.7%) funded through loans and a smaller fraction covered by grants.

Despite access to bilateral and multilateral funding, a significant portion of available resources remains untapped. There is a vast pool of international development funding accessible, and international partners are eager to provide support.

Private funding

Relying solely on public and international funding for the NAP will fall short as adaptation financing needs increase and the international funding landscape becomes more competitive. Additionally, these sources may not suffice for more expensive adaptation projects.

To resolve these concerns, the involvement of the private sector is critical. As the Global Commission on Adaptation put it in its Flagship Report, “the public sector needs to shift its focus to include both generating finance and creating incentives to scale up private sector engagement in adaptation investments” (GCA, 2019). However, globally corporations and institutional investors contributed a mere \$1 billion, which accounts for only 2% of the tracked adaptation finance in 2019 and 2020. This is in stark contrast to the significant 98% provided by public sources.

The private sector has good reasons to focus on climate adaptation due to physical and transition risks. These risks make adaptation investments financially prudent and crucial for long-term stability.



The Philippines recognizes the private sector's role in adaptation and has established lending instruments for climate projects. Examples include the Land Bank of the Philippines' Ecosystem Program and sub-loans via the Climate Special Adaptation Facility, as well as the Development Bank of the Philippines' Green Financing Program.

Furthermore, the Philippines has begun implementing regulatory measures to encourage increased private sector engagement. Among these measures are the issuance of circular no. 1085 by the BSP on April 19, 2020, outlining the Sustainable Finance Framework, Circular No. 1128 dated October 26, 2021, detailing the Environmental and Social Risk Management Framework, the green jobs act, the CREATE act, and Circular No. 1149 issued on August 23, 2022, providing guidelines on integrating sustainability principles into investment activities of banks. The implementation of these enabling policies has resulted in the issuance of over PHP 100 billion worth of sustainable bonds in 2020.

Despite the progress made, significant challenges persist for the private sector's active involvement in climate adaptation efforts. Private sector involvement in climate adaptation remains low in the Philippines. While financial institutions are increasingly issuing sustainability and green bonds, critical sectors (e.g., infrastructure) have yet to fully engage.

Key barriers for adaptation financing

Having explained the existing condition and difficulties related to different adaptation funding sources in the Philippines, the outlined challenges can be largely grouped into five pivotal barriers that have hindered the progress of adaptation financing in the country.

Narrative and information gaps

A lack of awareness hinders access to funding opportunities. For example, some LGUs and local groups are unaware of the PSF's details, preventing them from applying despite knowledge of suitable local adaptation solutions. Many private sector entities are also unaware of available funds like loans and grants from financial institutions to support adaptation programs.

Furthermore, weak technical expertise is a barrier to accessing funding. For instance, inadequate knowledge of the PSF's technical requirements prevented 44 NBS projects from applying for sufficient funding. International development funding sources have stringent requirements, demanding detailed adaptation data and technical information, which many implementing entities in the Philippines lack the capacity to provide.

Moreover, there are information gaps on climate risks and the benefits of timely adaptation. The notion that the cost of inaction is far greater than the cost of action is still not well understood and quantified. The Global Commission on Adaptation forecasts that a global investment of \$1.8 trillion from 2020 to 2030 could yield a total net benefit of \$7.1 trillion across five key areas, including early warning systems, climate-resilient infrastructure, and enhanced water resource resilience.

Lack of/limited bankability

Numerous adaptation strategies lack the ability to generate income streams (either through favorable revenues or cost reductions), making it difficult to secure funds for repayment. The relatively small sizes of adaptation projects may not attract traditional investors, and this challenge is amplified by the



public goods nature of adaptation within non-market-oriented or publicly dominated sectors. Consequently, the Philippines relies heavily on loans, contributing to its debt burden.

Revenue streams from adaptation projects are often perceived as low or non-existent. Specifically, a major obstacle to accelerating sustainable adaptation funding is the undervaluing of the private sector's role in adaptation. While the Philippines has taken steps to increase public funding, it has yet to focus on unlocking private sector funding, particularly by making semi-bankable projects financially appealing for private sector investments. Relatedly, as the private sector becomes more engaged in PPPs for adaptation projects, challenges arise in demonstrating project bankability to warrant PPP funding.

Project structure and procedural complexity

Project complexity poses investment hurdles, involving multiple sectors, location-specific factors, and diverse stakeholder alignment. Coordinating funders with distinct preferences in risk, return, and impact requires alignment among diverse perspectives. Limited transferability necessitates detailed financial evaluation, extensive risk analysis, and rigorous due diligence, increasing project financing costs and discouraging both developers and financiers.

Another challenge lies within the procedural complexity in obtaining these funds for the project. The disbursement of funds throughout the lifecycle of adaptation project is an example. For LGUs that receive funding approval, issues arise during implementation due to the PSF being disbursed in stages, with a significant portion provided in later tranches. This results in negative cash flow for LGUs during implementation, causing financial strain before majority of the funding is received.

Inadequate policies and regulations

Unclear policy signals can serve as a barrier. The absence of clear guidelines raises uncertainties for investors and financiers, who become uncertain about the regulations that oversee adaptation projects. This uncertainty contributes to an elevated perception of risks, potentially dissuading potential investors from investing in projects. Specifically, uncoordinated, and ambiguous cross-sectoral policies can impede private sector engagement in adaptation endeavors. For example, the water sector in the Philippines is grappling with insufficient private sector investment as existing tariff policies and the political pressure to maintain low water tariffs has discourage private investment. Furthermore, investing in adaptation, particularly in innovative areas, often demands changes to regulatory frameworks or permissions.

Lack of robust standards and budgeting

The absence of a shared 'language' for assessing adaptation risks is evident, with many global objectives, metrics, and methodologies in their infancy—unlike the more established frameworks in the realm of mitigation. In the absence of clear and consistent criteria, it becomes challenging to determine which projects align with climate adaptation goals. This lack of standardized assessment can result in confusion and ambiguity, leading to suboptimal project selection and resource allocation. Specifically, efficient utilization of funds emerges as a key concern within the Philippines as funding from international funders are often diverted from its intended focus to address other national priorities.



Moreover, without adopting an adaptation lens during budgeting, opportunities for targeted investments in climate-resilient projects might be overlooked. This omission can lead to underinvestment in critical sectors, leaving vulnerabilities unaddressed. Particularly, large projects in the Philippines lack a systematic screening process for assessing their vulnerability to either physical or transitional climate risks. The level of adherence to budget tagging requirements continues to be quite limited, as approximately only 10% of spending units report their climate-related expenditure. This is attributed to the fact that the integration of these expenditures into the budget management system has not yet been fully realized.¹⁸⁶

Key actions

Overall cross-cutting strategies

The Philippines needs to embark on a series of strategic action plans by addressing the crucial aspects of adaptation financing across the entire ecosystem. Table 5.1.6.1 below outlines the overarching cross-cutting list of actions.

Table 5.1.6.1. Overall cross-cutting list of actions

No	Overview of actions	Timeline ¹⁸⁷
AF 1	Develop national investment & financing plan: Formulate a national investment and financing plan aimed at quantifying adaptation costs, addressing financial gaps, prioritising interventions, and identifying strategies to unlock access to sustainable financing options for each recognized adaptation priority. Critical to consult with wide range of stakeholders, including local and vulnerable communities.	Immediate (0-3 years)
AF 2	Create investor database for climate risks and events: Provide access to historical climate data and develop predictive models to assist key stakeholders in efficiently funding critical adaptation priorities. Continuously monitor and compile data and trends to furnish investment-related insights for adaptation efforts. (e.g, leverage on existing DOST PlanSmart, a unified government entity platform. PlanSmart, specifically GeoRisk, acts as central data lake for climate-related data and information. The tool's goal is to present LGUs with projected climate hazards, enable the	Immediate (0-3 years)

¹⁸⁶ World Bank (2022). Philippines, Country Climate and Development Report

¹⁸⁷ Immediate – needs to be done earliest as possible to lay the foundation for other activities; medium-term – important activities unlocked / can be done after establishing foundational activities



	ability to add historical hazards and their impact over time, and formulate a standardized adaptation plan.)	
AF 3	Implement technical assistance programs aimed at enhancing awareness and technical proficiency in adaptation financing: Educate relevant stakeholders on existing adaptation financing sources and provide support on how to strategically unlock potential financing opportunities. This can be done through strategically leveraging the expertise of local and international partnerships. (e.g., Partnering with the Global Centre for Adaptation to provide capacity building workshops for LGUs and local DFIs)	Immediate (0-3 years)
AF 4	Institutionalize a national focal entity for adaptation finance: Function as a unified entity that centralizes all adaptation-related finances and projects, offering comprehensive oversight of macro-level developments, create a robust pipeline of adaptation projects that are financially feasible and attractive and act as a coordination platform for matchmaking opportunities between key stakeholders. (e.g., leverage on National Resilience Council as a starting point)	Medium-term (3-6 years)
AF 5	Enhance national sustainable finance taxonomy: Continue developing the Philippine Sustainable Finance Taxonomy Guidelines for more effective and accurate reporting as aligned to PDP 2023-2028 strategy to mainstream sustainable finance.	Medium-term (3-6 years)

Domestic public funds

As domestic public funding is the primary source for financing adaptation projects, the Philippines is committed to implementing a set of action plans outlined in Table 5.1.6.2.

Table 5.1.6.2. Domestic public funding sources list of actions



No.	Overview of actions	Timeline ¹⁸⁸
AF 3	Implement technical assistance programs aimed at enhancing awareness and technical proficiency in adaptation financing: To educate public sector actors on existing adaptation financing sources and provide support on how to strategically unlock potential financing opportunities. This can be done through strategically leveraging the expertise of local and international partnerships. (e.g., leveraging regional development councils or leagues to inform far-flung LGUs and organizations on available national financing facilities & corresponding requirements, raising awareness and capacitating implementing entities on DOST's PlanSmart to generate local vulnerability assessments and technical proposals)	Immediate (0-3 years)
AF 6	Integrate adaptation lens into public finance management: Actively incorporate an adaptation lens into the operations and future undertakings at all level of governments, as climate events are critical fiscal risk that needs to be integrated in fiscal planning. (This includes (i) identifying and quantifying climate risks (i.e., take stock of public assets exposed to natural hazards, especially critical public services), (ii) disclosing climate-related fiscal risks (i.e., as part of the overall fiscal risk statement) to guide policymakers, and (iii) embedding climate risks in fiscal planning and make provisions in the budget (i.e., investing in resilience, fiscal buffers, budget flexibility)) (IMF, 2022).	Immediate (0-3 years)
AF 7	Enhance climate adaptation tagging from national budget: Ensures dedicated funding for adaptation initiatives are tagged correctly to ensure a systematic way of tracking adaptation finance (e.g., Build on the PSFR plan to identify and implement the necessary enhancements for the Climate Change Expenditure Tagging)	Immediate (0-3 years)
AF 8	Prioritize funding for social welfare and community adaptation:	Immediate (0-3 years)

¹⁸⁸ Immediate – needs to be done earliest as possible to lay the foundation for other activities; medium-term – important activities unlocked / can be done after establishing foundational activities



	To channel significant domestic public funding to social resilience of communities, ensure equitable resilience-building and prevent exacerbation of existing inequalities. (e.g., provide cash transfers, relocate vulnerable communities, integrate the Philippines' Population, Health, and Environment Approach)	
AF 9	Improve funding source disbursement rules: Align national funding sources disbursement regulations according to implementing entity needs and contexts. (e.g., Increasing PSF's upfront funding amount to approved projects)	Medium-term (3-6 years)
AF 10	Mainstream existing Program Convergence Budgeting: Expand government's program convergence budgeting approach across provinces, especially important given slow uptake (i.e., 14 out of 82 provinces covered by 2021)	Medium-term (3-6 years)

International development funding

The Philippines has cultivated strong partnerships with numerous international actors, and the interest from international development funding institutions to support the country remains high. This situation provides the Philippines with a significant avenue to complement its domestic public funding sources and expedite its adaptation efforts. The Philippines is committed to executing a series of action plans as outlined in table 5.1.6.3.

Table 5.1.6.3 International development funding sources list of actions

No.	Overview of actions	Timeline ¹⁸⁹
AF 3	Provide technical assistance programs to build awareness and technical capabilities on adaptation financing:	Immediate (0-3 years)

¹⁸⁹ Immediate – needs to be done earliest as possible to lay the foundation for other activities; medium-term – important activities unlocked / can be done after establishing foundational activities



	To educate local stakeholders on existing adaptation financing sources from international development funders and provide support on how to strategically unlock potential financing opportunities. This can be done through strategically leveraging the expertise of local and international partnerships. (e.g., Strengthening direct access by facilitating new accreditations to Climate Financial Intermediary Funds, facilitating inter-agency workshops discussing available international adaptation financing facilities & their corresponding requirements)	
AF 4	Institutionalize a national focal entity for adaptation finance: Function as a unified entity to (i) map of available international funding sources along with their associated key requirements and (ii) monitor the utilization of acquired international development funding. Information should be made available to across govt and project proponents.	Medium-term (3-6 years)
AF 11	Utilize existing platforms to expand partnership network: Capitalize on established networks such as the ENACT contact group to establish and cultivate enduring partnerships with diverse international development funding providers.	Immediate (0-3 years)

Private funding

Private sector involvement in adaptation financing has remained minimal. It is imperative to engage them to bridge the adaptation financing gap in the Philippines. Consequently, the Philippines is dedicated to the action plans outlined in table 5.1.6.4 which are aimed at enhancing the participation of private sector players.

Table 5.1.6.4 Private funding sources list of actions

No.	Overview of actions	Timeline ¹⁹⁰

¹⁹⁰ Immediate – needs to be done earliest as possible to lay the foundation for other activities; medium-term – important activities unlocked / can be done after establishing foundational activities



AF 2	Create investor database for climate risks and events: Provide access to historical climate data and develop predictive models to assist key stakeholders in efficiently funding critical adaptation priorities. Continuously monitor and compile data and trends to furnish investment-related insights for adaptation efforts. (e.g, leverage on existing DOST PlanSmart, a unified government entity platform. PlanSmart, specifically GeoRisk, acts as central data lake for climate-related data and information. The tool's goal is to present LGUs with projected climate hazards, enable the ability to add historical hazards and their impact over time, and formulate a standardized adaptation plan.)	Immediate (0-3 years)
AF 3	Provide technical assistance programs to build awareness and technical capabilities on adaptation financing: To educate relevant stakeholders on existing adaptation financing sources and provide support on how to strategically unlock potential financing opportunities. This can be done through strategically leveraging the expertise of local and international partnerships. (e.g., Communicate evaluation criteria to private sector on how to access funds, facilitating private sector forums to discuss the important role private sector plays in funding adaptation gap, raising awareness and capacitating implementing entities on DOST's PlanSmart to extract adaptation-related data & information that private sector can use)	Immediate (0-3 years)
AF 4	Institutionalize a national focal entity for adaptation finance: Function as a unified entity that centralizes all adaptation-related finances and projects, offering comprehensive oversight of macro-level developments, create a robust pipeline of adaptation projects that are financially feasible and attractive and act as a coordination platform for matchmaking opportunities between key stakeholders. (e.g., leverage on National Resilience Council as a starting point)	Medium-term (3-6 years)
AF 12	Integrate adaptation lens into private sector operations:	Immediate



	Actively incorporate an adaptation lens into the operations and future undertakings for private sector players by climate stress testing investment portfolios to understand existing risks and impacts, develop measures to address risks identified and explore opportunities to invest in climate adaptation (e.g., integrate adaptation-related disclosures from private sector in ESG reporting)	(0-3 years)
AF 13	Integrate adaptation lens in PPP funding: Devise strategies to include private sector-driven adaptation solutions within Public-Private Partnership (PPP) funding mechanisms, ensuring wider sector coverage. (e.g., enhancing the PPP's requirements to consider costs of inaction; tapping international funding facilities to conduct public and private policy reforms)	Immediate (0-3 years)
AF 14	Develop private sector engagement mechanisms: Establish clear and effective mechanisms to engage the private sector, encouraging their active participation in climate adaptation initiatives. (e.g., developing regular and frequent private sector leaders forum to provide key developments related to adaptation such as the National Resilience Council and the Philippine Disaster Resilience Foundation)	Immediate (0-3 years)
AF 15	Co-develop financing models accelerating private investments: Collaboratively develop creative financing models that expedite private sector involvement in various sectors, accelerating their contribution to adaptation efforts. (e.g., co-developing blended finance schemes to attract private sector investment in projects that would otherwise not attract investments)	Immediate (0-3 years)



Innovative financing instruments

There is a growing recognition amongst practitioners that countries must explore options outside the conventional reservoirs of funds—namely, grants and loans—toward innovative financing instruments that can unleash further investments. This includes accessing financial resources from a range of entities such as financial institutions, private investors, institutional investors, impact investors, foundations, and philanthropists. These tools have the potential to unlock more adaptation funding because of their ability to attract investors with different risk profiles and investment horizons.

At present, the Philippines has initiated the implementation of several innovative financing instruments, such as Catastrophe-Deferred Drawdown Option and CAT bonds. As many of these instruments are still nascent, the Philippines is dedicated to the action plan outlined in table 5.1.6.5. This aims to systematically codify the insights learned from the following innovative funding instruments in order to comprehensively understand the impacts of these instruments and determine their viability for the future. The existing innovative financing instruments, which are not limited to those listed, can be found in Chapter 5 Appendix.

Table 5.1.6.5. Innovative Financing Instruments action plan

No.	Overview of actions	Timeline ¹⁹¹
AF 16	Codify the insights learned from the existing innovative financing instruments: Monitor and evaluation of existing financing instruments to comprehensively understand their impacts and determine their viability for the future.	Immediate (0-3 years)

It is also important for the Philippines to continuously explore a range of other financing instruments to achieve these goals. Many of these instruments have demonstrated promising outcomes. Thus, the Philippines is committed to the action plan outlined in table 5.1.6.6 by considering the following innovative funding instruments below in table 5.1.1.7.

Table 5.1.6.6 Innovative Financing Instruments action plan

No.	Overview of actions	Timeline ¹⁹²
AF 17	Accelerate use of innovative financing instruments:	Immediate (0-3 years)

¹⁹¹ Immediate – needs to be done earliest as possible to lay the foundation for other activities; medium-term – important activities unlocked / can be done after establishing foundational activities

¹⁹² Immediate – needs to be done earliest as possible to lay the foundation for other activities; medium-term – important activities unlocked / can be done after establishing foundational activities



	Explore the viability of the different financing instruments and develop strategy to accelerate selected instruments.	

Table 5.1.6.7 List of innovative funding instruments for consideration

Instrument type	Description ¹⁹³	Key advantage ¹⁹⁴	Key consideration
Pooled investment fund	Financial vehicles combining capital from different entities (e.g., public funding, international funding providers, private sector) and then deploy it to projects with specific development or sectoral objectives.	Brings layers of capital with differing return-impact considerations under one platform.	The project or initiative should yield a satisfactory return on investment for its investors.
Guarantee schemes / programs	Provided to lenders to cover non-commercial risks. These catalyzes bringing additional private capital to the table who might otherwise not participate.	Catalysts for bringing additional capital that would not otherwise be available, resulting to leverage ratio of up to 5x.	Typically appear on the balance sheets of guarantors for the complete sum, and consequently, they are not as favored by guarantors as other instruments (such as loans).
Debt-for-nature swaps	Debtor country allowed discounts on the debt owed to its creditor in exchange for investments towards conservation. This frees up fiscal resources for governments to improve resilience without triggering a fiscal crisis.	Frees up fiscal resources for governments to improve resilience without triggering a fiscal crisis.	Creditor governments need to establish legal assurance to ensure that debt-for-nature swaps lower the debt burden to the extent agreed.
Adaptation Benefits Mechanism	Reputable international organizations will be able to certify the benefits of specific adaptation activities (Certified	Acts as extra security/collateral when seeking upfront loans or equity investments to attract initial investors.	Requires agreed-upon methodologies to capture the impact of adaptation activities.

¹⁹³ [IISD](#) (2023)

¹⁹⁴ Ibid.



	Adaptation Benefits) to project developers and/or governments.		

Conclusion

In sum, this section has explored the landscape of adaptation finance in the Philippines, along with the barriers faced in attracting adaptation financing. It then outlines a series of actions to tackle these challenges in a comprehensive way. The success of the NAP hinges on financing as an enabler – it has the power to determine whether we succeed or fail in protecting the Philippines against the impacts of climate change.



5.2 Implementation roadmap

The NAP roadmap outlines a high-level plan of activities to kickstart the National Adaptation Plan (NAP) implementation. It focuses on the necessary next steps based on the understanding of priorities for the country based on analysis in Chapter 3 on climate analytics, recommendations on adaptation priorities in Chapter 4, and enablers required to support implementation in Chapter 5, leading to specific initiatives and activities. The roadmap includes actions at both national and local levels, recognizing their interconnected roles.

The features of the NAP roadmap for initial implementation are summarized below:

- Overarching initiatives for the NAP's initial implementation (immediate, within 3 years) that are driven by specific actions that relate to chapters on climate analytics, adaptation priorities, and implementation, with each initiative contributing to the broader goal of effective adaptation.
- National and Local level of implementation, with select initiatives needing cooperation between national (including sectoral) and local efforts.
- High-level potential strategic indicators that will track progress, accountability, and success.
- Defined lead and supporting agencies for key activities to ensure clear and synchronized implementation.
- Indicative timescales for key activities.

The NAP Roadmap: Initial implementation¹⁹⁵

Level of implementation	Category	Activity	Potential indicators	Lead agencies	Supporting Agencies	Timescale
National	Initiative 1: Clearly define roles, responsibilities, and institutional arrangements for the NAP to mainstream A&R in national agenda					
	Governance & Institutions	Design national level governing structure and coordinating mechanism for the NAP, integrated, and aligned with existing adaptation mechanisms (e.g. Philippine Development	• Approved and operational institutional framework for implementing NAP • Clearly demarcated roles and responsibilities of government	CCC DENR	NAP NSC Members	Q1 to Q2 2024

¹⁹⁵ Immediate focus for first few years of NAP implementation. Periodic progress assessments are essential during the NAP review phases to allow for necessary adjustments in the implementation plan, informed by valuable insights gained from practical experience.



		Plan, National Climate Change Action Plan, National Adaptation Plan)	- units and institutions • Designated decision-making body, technical working group, data office, finance focal entity, and focal climate change adaptation points in sectoral entities for NAP implementation • Coordinating mechanisms seamlessly integrated with key country frameworks e.g. PDP 2023, NCCAP, NDC, etc.			
	Governance & Institutions	Define horizontal (sectoral) and vertical (LGU) integration strategy to embed LGUs in permanent institutional arrangements	• Approved and operational sectoral and LGU integration strategy for institutional arrangements	CCC DENR	DILG RDC	Q3 2024
	Initiative 2: Enhance stakeholder engagement and communication strategies to amplify NAP awareness and understanding					
	Stakeholder engagement	Identify engagement gaps & opportunities	• Key stakeholder groups and their pain	CCC DENR	DILG CHED	Q4 2023



		to boost involvement of key stakeholder groups (e.g. private sector, academia, vulnerable groups, indigenous communities, civil society groups, youth and elderly, etc.)	- points and needs identified and specified - Roles, responsibilities, and coordinating mechanisms of stakeholder groups detailed			
	Stakeholder engagement	Develop and deploy inclusive, collaborative, understandable, and transparent stakeholder engagement strategy tailored for sectoral and local entities to build awareness for the NAP	- Simplified and abbreviated version of NAP to summarize key insights relevant for sectoral and local entities created - Stakeholder engagement strategy developed and operational - Various and relevant communication techniques used to engage specific stakeholder groups	CCC DENR	DILG CHED PCO DepEd	Q1 to Q2 2024
	Initiative 3: Downscale climate analytics and enhance adaptation data management and application					
	Climate Analytics	Build new/build on existing analytical	Downscaled climate analytics for prioritized	DOST	CCC DENR DILG	Q4 2023 to Q1 2024



		models downscaled at a sectoral and local level, translating climate change data into actionable insights for sectors and LGUs	sectors and provinces (note: may first need to address concern on limited observation stations in the Philippines to fully downscale analytics)		DHSUD PSA	
	Data & knowledge infrastructure	Stock-take and encode existing climate data in data lake	- Centralized climate information platform developed - Existing climate data collected and encoded into centralized database - Database and progress dashboard published and regularly updated	DENR	CCC PSA DICT DOST	Q4 2024
	Data & knowledge infrastructure	Establish well-defined and user-friendly protocols for the collection of climate information	User-friendly data collection and management protocols developed and shared	DOST	CCC DENR	Q2 to Q3 2024
	Initiative 4: Translate adaptation strategies into a sectoral-level program/project portfolio, prioritizing based on social, economic, and ecosystem benefits for informed decision-making					



	Adaptation priorities	Leverage climate analytics and insights on social, economic, and ecosystem returns to prioritize most exposed sectors and develop phased approach to engage sectors	Prioritized sectors identified, and phased approach to engage sectors based on prioritization developed	CCC DENR	DOST DND- OCD NEDA PSA DILG DSWD	Q1-Q2 2025
	Adaptation priorities	Develop sectoral adaptation program/project portfolio, indicators, and implementation plan in line with current and future sectoral plans & priorities	Number of adaptation programs/projects developed by key sectors	Sectoral Agencies	CCC DENR NEDA DA DOE DOTr DOH DTI DOLE DHSUD	Q3 to Q4 2024
	Initiative 5: Develop a national adaptation investment strategy to mobilize resources needed for adaptation programs					
	Adaptation Financing	Develop national investment & financing plan	- Approved and deployed national adaptation investment plan to assess bankability of sectoral adaptation programs/projects - Contributions from	CCC DOF	NEDA DSWD SEC DBM BSP	Q4 2024 to Q2 2025



			domestic sources, private sector, development partners, and international funds			
	Adaptation Financing	Create investor database for climate risks and events	Database developed and operational	CCC DOF		Q2 2025
	Adaptation Financing	Provide technical assistance programs to build awareness and technical capabilities on adaptation financing	- Number of technical assistance programs - Awareness of relevant stakeholders	CCC DILG DOF		Q2 2025 to Q2 2026
National and Local	Initiative 6: Translate adaptation strategies into a provincial-level program/project portfolio, prioritizing based on social, economic, and ecosystem benefits for informed decision-making					
	Adaptation priorities	Leverage climate analytics and insights on social, economic, and ecosystem returns to prioritize most exposed LGUs and develop phased approach in plan to cascade sectoral adaptation programs/projects	Highly exposed local government units (LGUs) prioritized and phased approach to engage LGUs based on prioritization developed	Sectoral agencies DENR CCC	DA DILG	Q1-Q2 2025



	Adaptation priorities	Cascade priority sectoral adaptation programs/projects to LGUs and equip with necessary capacity building initiatives for implementation	- Adaptation plans integrated with LCCAP - LGUs onboarded on sectoral adaptation programs/projects	Sectoral agencies	DA DILG CCC DHSUD DENR NEDA DOE DOTr DOH DTI DOLE	Q3 2025 onwards
	Adaptation priorities	Implement adaptation programs/projects by LGUs, supported by proper monitoring & feedback mechanisms	Number of programs/projects implemented by LGUs	CCC, DILG for LCCA, LGUs	NAP-NSC	Q4 2025 onwards
	Adaptation priorities	Conduct localized consultation engagements, prioritizing vulnerable communities, to tailor projects and address critical needs	Number of consultations with vulnerable communities conducted	CCC DENR	PCW NCSC NYC NAPC NCDA	Q4 2025 onwards
	Initiative 7: Enhance capability building, research, and innovation on the topic of climate change adaptation					
	Skills & Capacity building	Identify knowledge, skill, and capacity gaps in relation to climate change adaptation across	Knowledge, skill, and capacity gaps identified on national and local level	CCC DENR DILG		Q2 2024



		national and local entities				
	Skills & Capacity building	Identify and promote government and non-government adaptation champions	Adaptation champions from government and non-government entities identified	CCC DENR DILG	NAP-NSC	Q2 2024
	Skills & Capacity building	Strengthen technical and institutional capacity of agencies across specialized adaptation topics tailored to address key issues and needs (e.g., training programs, technical assistance programs)	- Number of capability-building training programs and initiatives - Number of technical assistance programs - Tools provided to key stakeholders identified to access, analyze, and interpret climate data	CCC DENR	DOST	Q4 2024-Q4 2026
	Technology & innovation	Reform policies to facilitate adaptation-related R&D/innovation and guardrails to protect vulnerable communities from undesired consequences of adaptation solutions	- Policies reformed to facilitate adaptation R&D and innovation - Safeguards in place protect vulnerable communities from potential consequences of adaptation solutions	CCC DENR DOST		Q4 2024 onwards



	Technology & innovation	Promote adaptation-focused R&D in collaboration with non-state entities	• Collaboration and networking among the public and private sector, civil society, academia, NGOs, and other key stakeholders • Number of R&D concepts developed • Number of R&D concepts turned into viable projects	CCC DENR DOST		Q4 2024 onwards
	Initiative 8: Develop effective MEAL system for climate change adaptation					
	MEAL	Develop a framework and specific key indicators for adaptation monitoring, evaluation, assessment, and learning implementation that is aligned with existing adaptation mechanisms and will be used for knowledge sharing to key stakeholders and relayed to policymakers to iterate the NAP	• MEAL indicators in place for NAP implementation • Regular MEAL reports at the national, local, and project levels that are shared with key stakeholders • Iterations to NAP based on MEAL reports and insights	NEDA	CCC DENR NAP NSC Members	Q3 2024



International	Initiative 9: Align the National Adaptation Plan with the Glasgow-Sharm El-Sheikh Work Programme on the Global Goal on Adaptation					
	International negotiation	Identify linkage between the NAP and the GGA framework, and ensure the alignment of the NAP with the global framework in the succeeding iterations.	- Number of consultation workshops with agencies and members of the Philippine delegation to international negotiations and relevant stakeholders - Iterations to NAP based on the result of consultation workshops.	CCC DFA	Members of the Philippine Delegation to UNFCCC events and other relevant stakeholders	Q2 to Q3 2024



5.3 Monitoring, evaluation, accountability, and learning (MEAL) system

The NAP Monitoring, Evaluation, Accountability, and Learning (MEAL) refers to the systematic processes and tools to measure, evaluate, and disseminate the effectiveness of adaptation actions within the NAP. The MEAL system is composed of four key components defined in this document as follows:

1. **Monitoring** – Continuous, routinary, and systematic information collection and analysis to measure progress against key objectives.
2. **Evaluation** - Systematic and objective assessment of on-going or completed projects, programs, policies, etc.
3. **Accountability** - Systematic processes & tools to guarantee ownership such as tracking, reporting, and well-defined roles & responsibilities.
4. **Learning** - Systematic collection and sharing of insights to enable continuous development.

5.3.1 Purpose

The NAP MEAL system strategically drives NAP action plan implementation in the Philippines. It ensures timely delivery through clear ownership and monitoring. Immediate indicators assess plan effectiveness, allowing early adjustments. Long-term impact indicators track adaptive capacity, resilience, and development progress. It captures key learnings and science-based insights for ongoing improvement.

5.3.2 Action plan

Philippines' MEAL system action plan is guided by ten key guiding principles emerging from best practices & key learnings from other NAPs.

1. Fit-for-purpose: Clarity of purpose is the foundation.
2. Participatory: Engaging stakeholders in continuous development.
3. Strong government alignment: Aligning with key agencies (e.g. NEDA).
4. Strong ownership: Clearly defined roles and responsibilities.
5. Socially inclusive: Capturing progress for vulnerable groups.
6. Built from existing: Leveraging current frameworks to avoid duplication.
7. Transparent: Openly sharing results and findings.
8. Comprehensive: Showing adaptation progress with select indicators.
9. Resource-efficient: Maximizing measurement with minimal resources.
10. Progressive: Incorporating key learnings and scientific advancements.

Following these key principles, the Philippines will develop the MEAL system in two broad phases: design, and execution phases, as shown:

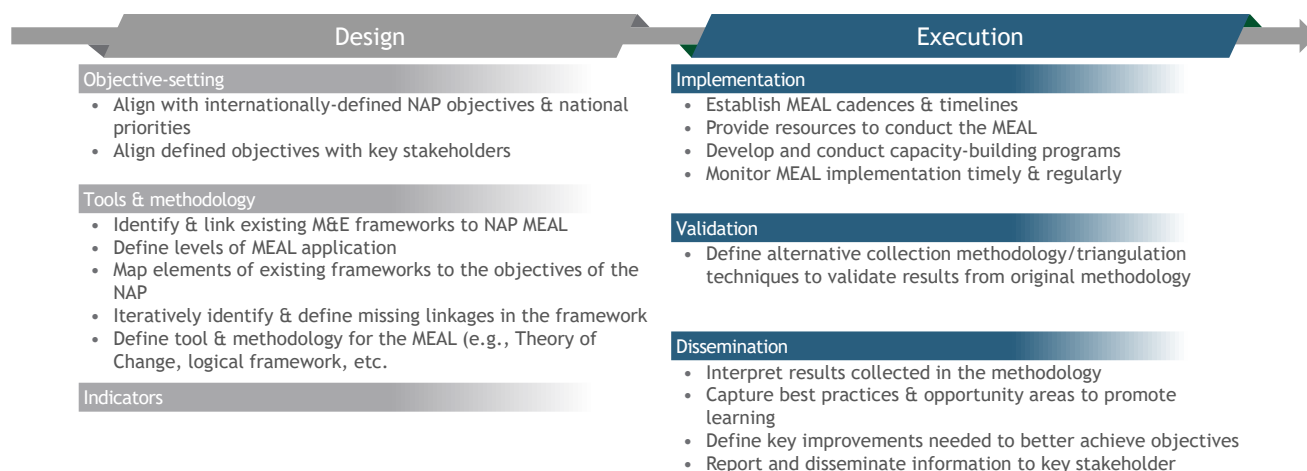


Figure 5.3.2.1 MEAL system action plan

Design phase

Objective-setting: The MEAL system design phase defines NAP objectives and scope. It ensures alignment with national priorities and international goals.

Tools and methodology: Key tools, methodologies, and frameworks for the MEAL will be defined in alignment with the set MEAL objectives.

To enrich the MEAL system, existing frameworks, including the NCCAP RBMES, sector-specific M&E frameworks, other existing action plans¹⁹⁶ and any other future action plans will be assessed. This evaluation will also consider globally recognized climate actions and frameworks like Stocktaking for National Adaptation Planning (SNAP) tool; Progress, Effectiveness, and Gaps (PEG), Pilot Program for Climate Resilience (PPCR) monitoring & reporting toolkit, and the vulnerability sourcebook. Additionally, hybrid frameworks like Tracking Adaptation and Measuring Development (TAMD) Making Adaptation Count will be explored. In addition, the MEAL strategy will align with international agreements such as the Global Goal on Adaptation.

Leveraging existing frameworks, especially at the national level, will define MEAL levels and approaches. Once established, linkages among relevant frameworks will identify critical gaps and guide the selection of suitable tools. This may involve developing a national Theory of Change or logical framework through extensive consultations and stakeholder engagement.

Indicators: To measure comprehensively, the Philippines will adapt (e.g., SDG indicators from NEDA) or develop indicators, considering key factors:

1. Aligning adaptation goals with chosen indicators
2. Optimizing indicators for cost-effective monitoring.
3. Ensuring comprehensive indicators to avoid misinterpretation.

¹⁹⁶ Examples: National Security Policy, Philippine Water Supply and Sanitation Master Plan, Philippine Action Plan for Sustainable Consumption and Production – PAP4SCP, Roadmap to institutionalize Natural Capital Accounting in the Philippines, National Renewable Energy Program 2020-2040, Philippine Energy Plan 2020-2040, and Philippine Development Plan 2023-2032



4. Choosing indicators easily understood and accepted by NAP stakeholders.
5. Maintaining flexibility for evolving science and learning from adaptation actions.

Selected indicators will have defined measurement methods, such as manual tracking, proxy data use, interviews, analysis, aggregation, or a hybrid approach. Each indicator will have designated owners for regular updates. Baseline methods for these indicators will be established using secondary data, interviews, assessments, or a combination, forming the foundation for progress measurement in the NAP.

Execution phase

Implementation: The Philippines will calculate and allocate resources required for the NAP MEAL system. It will collaborate with government bodies and educational institutions for upskilling programs, establishing clear schedules and timelines for effective implementation. A national entity will monitor MEAL progress.

Validation: The responsible bodies are tasked to devise alternative information collection methodologies to validate or triangulate findings from initially outlined approaches. Experts will be engaged to aid in creating and implementing these triangulation methodologies.

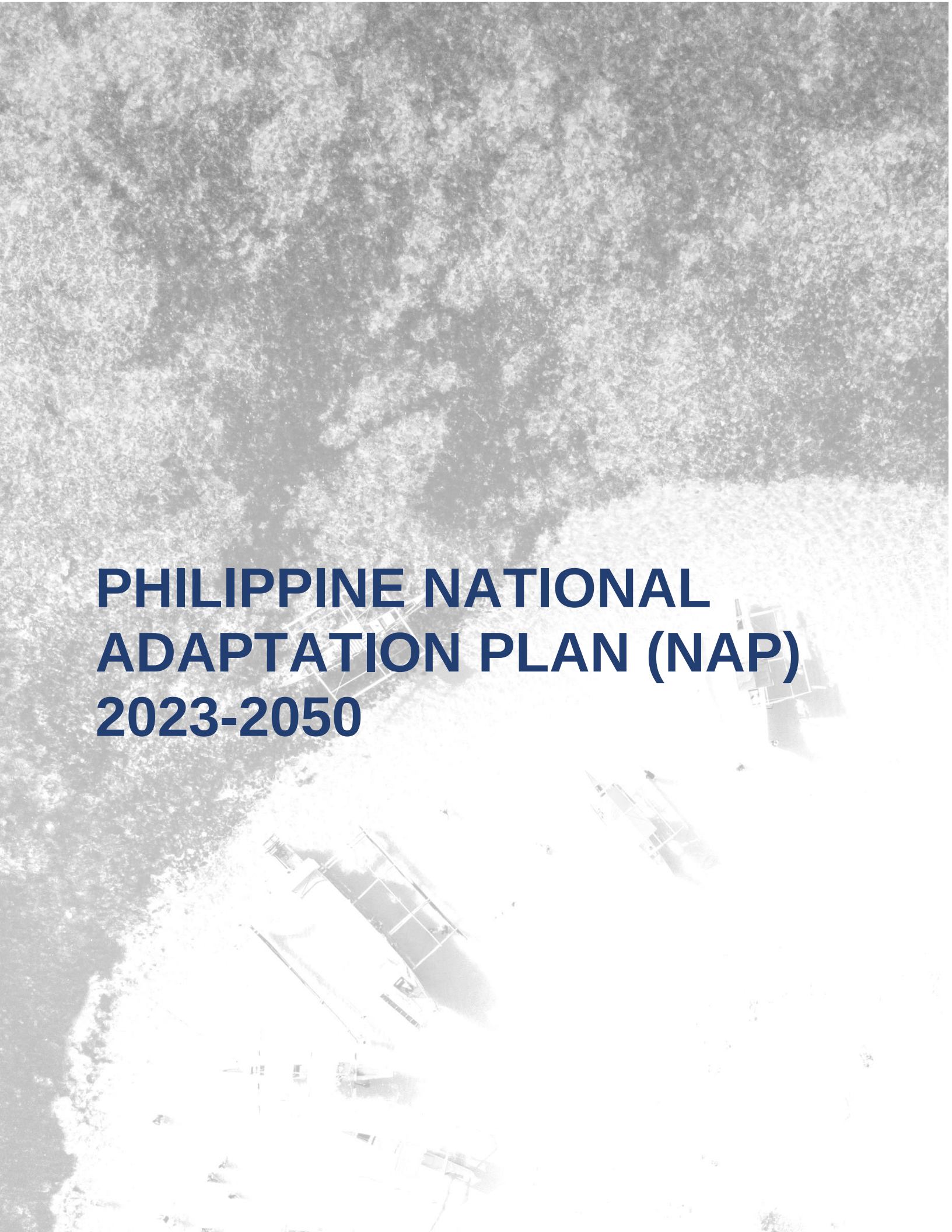
Dissemination: The Philippines will create feedback and insights mechanisms to facilitate cross-body learning, ensuring local experiences and indigenous knowledge are shared and scaled. It will collaborate with higher education institutions to disseminate research findings for NAP strategies.

5.3.3 NAP revisions and updates

The Philippines' NAP is a dynamic document influenced by insights from the MEAL system. It will align with existing review systems like NCCAP, NDC, PDP, National Security Policy, and other potential future action plan reviews. In the early years, frequent assessments will focus on building a strong national adaptation infrastructure. An intermediate assessment at 3 years or sooner adjusts based on activity outcomes. This aligns with changes in local administration. From the second NAP version onward, updates occur every 5 years, aligning with national strategy document reviews, and national administrative changes.

Table 5.3.3.1. NAP revisioning and updating cadences

Activity	Responsible entity	Frequency
NAP local & sectoral process review and monitoring	Respective LGUs & agencies with guidance of NEDA and CCC	Annually or as necessary
National process review, monitoring, and assessment	NAP focal entity guided by CCC & NEDA	Annually or as necessary
Mid-term detailed NAP progress assessment	NAP focal entity, CCC, and NEDA	Every 3 years or as necessary
NAP document updating	NAP focal entity, CCC, and NEDA	Every 5 years or as necessary

An aerial photograph of a tropical coastline. The top half of the image shows a dense, dark green forest. The bottom half shows a light-colored sandy beach with several large, modern buildings and structures, possibly a resort or government complex, situated along the shoreline. The text is overlaid on the forest area.

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